MYCOLOGIA

VOL. XV SEPTEMBER, 1923 No. 5

THREE NEW MYRIANGIACEOUS FUNGI FROM SOUTH AMERICA

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(WITH PLATES 18–20)

The fungi here described were found by the junior author in microtome sections made for the study of other fungi on the leaves, and for which the specimens were collected in British Guiana during the summer of 1922. Though the presence of these Myriangiaceous fungi was not recognized until the microtome sections were examined, due to the superficial resemblance of them to the other fungi upon the leaves (in one case, *Endodothella Tapirae;* in the others, *Phyllachora* and *Echidnodella*), once it was known they were there, they could easily be distinguished under the hand lens, or even without it. Descriptions of the fungi follow, also a discussion of their taxonomic position. Specimens are deposited in the herbarium of the University of Illinois and the New York Botanical Garden.

Myrianginella Stevens & Weedon, gen. nov.

Myriangiaceous; stroma developing within the host and erumpent, producing a superficial, irregular excrescence with undifferentiated surface. Asci at different levels, separated by mycelial pseudoprosenchyma. Spores muriform, hyaline. Distinguished from *Myriangina* by the superficial development of its ascoma.

Myrianginella Tapirae Stevens & Weedon, sp. nov.

Figs. 1, 2, 6–9

The fungus appears as small, reddish-brown excrescences, which vary in size from 0.1 to 0.25 mm. in diameter; the leaf being pale-yellow for a distance of 0.5 mm. surrounding them. The spots

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are visible from both sides of the leaf, and, as a rule, the fungus appears on both sides of the spot. The ascoma is undifferentiated on its surface, slightly mushroom-like, enlarging to a greater diameter after it emerges above the leaf surface; total diameter 327–374 μ. A double ascoma measures upward to 468 μ in depth; a single ascoma 312 μ deep and often bears a basal clypeus which is from 31–78 μ in thickness. Asci ovate, 36–43 x 25–36 μ, scattered, heavy-walled, separated by pseudoprosenchyma, not by paraphyses. Spores clavate-oblong, larger at one end, muriform, having several transverse septa, and at the broader end one or more vertical septa. Spores 18–22 μ long by 7 μ wide at their widest point, hyaline, thick-walled.

On *Tapira* sp. British Guiana: Kartabo, 7–22–22, No. 525. The same specimen bears also *Endodothella Tapirae* Stevens.

The specimens were collected for the black dothideaceous *Endodothella* (Figs. 1, 2), and it was at first thought that the red-topped fungi also on the leaf pertained to this fungus. It was only upon examination of microtome sections that the actual presence of two fungi was revealed.

Usually the fungus appears on both sides of the leaf, forming a double ascoma, Fig. 7; when on only one side, Figs. 6, 8, it is a single ascoma. The portion of the stroma near the center of the leaf is usually sterile and is composed of very fine hyaline threads. The riper asci are always near the surface. As many as twenty-five have been seen in a single vertical section of a double ascoma. The youngest are found near the center of the leaf in double ascomata and near the base in single ascomata. The stroma is a very light brown toward the surface, but is not at all differentiated into a cortical layer. Deeper and at the center it consists of a thin, hyaline mycelium. Frequently in double ascomata there is a region midway between the two surfaces of the ascoma where the mycelium is quite dark, while in single ascomata a border of such dark mycelium may surround the ascoma on all sides and on the bottom, though not on the top, giving the whole structure much the general appearance of a cluster cup, Fig. 6. The epidermal cells, below the base of a single ascoma, are usually filled with these dark hyphae, forming a true clypeus, and a considerable cavity, up to 70 μ thick, may exist in the palisade tissue, between this clypeus and the dark basal layer of the ascoma, this space

being filled with the typical hyaline, thin mycelium of the ascoma, Fig. 6. The palisade cells in these regions are disorganized and filled with mycelium. Outside of the region bounded by the dark mycelium and extending for a considerable distance (70 μ) into the host is found the normal, fine, hyaline mycelium.

Scattered throughout the ascoma are spherical, thick-walled asci, Fig. 9; mature ones at the surface, young ones below. When these asci are crushed a mass still resembling an ascus and bearing spores is expelled (Fig. 9). This measures from 67–70 by 17–28 μ, and appears to have a definite wall of its own. When stained lightly with iodine the spores became straw-colored, the inner spore envelope dark brown, and the ascus pale yellow.

It is probable that the double ascomata are formed by the rupture of the basal boundary of a single ascoma in the central portion of the leaf. This boundary, as has been mentioned above, is composed of dark brown mycelium which invades the leaf cells immediately surrounding the lower half of the ascoma. The boundary layer is often found broken, or in remnants, Fig. 6, and extending from it to the opposite side of the leaf can be seen the developing ascigerous stroma. The pressure of mycelial growth is presumably at the center of the base of the boundary layer, for it is here that the break occurs. The second ascoma thus to develop is at first covered with a heavy, brown clypeus composed of the epidermal cells filled with dark brown mycelium. When the second half of the double ascoma has developed, so as to emerge upon the opposite side of the leaf, the clypeus drops off.

Kusanoopsis Stevens & Weedon, gen. nov.

Myriangiaceous. Ascoma from an intramatricular mycelium, erumpent, cushion-shaped, attached by a central foot. Asci at different levels, outer layer not differentiated. Spores muriform, hyaline.

In form of stroma this resembles *Kusanoa,* but differs from it in the absence of a differentiated cortex as well as essentially in spore structure. It also resembles *Dictyonella erysiphoides* (Rehm.) v. Höhn.[1] in the form of the ascoma, but differs from

[1] v. Höhnel, F., Fragmente zur Mykologie, 6. Sitzber. d. k. Akad. d. Wissenschaft in Wien. Math.-nat. Kl. 118: 369 Ab. I. 1909.

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it in that our fungus has the asci in several, not one, layers, and still more essentially in several other characters.

Kusanoopsis guianensis Stevens & Weedon, sp. nov.

Figs. 3, 4, 10–15

Spots 0.25–1 mm. in diameter, dull-black, surrounding leaf faint pink for a distance of 1 mm.; usually epiphyllous, occasionally hypophyllous. Ascoma superficial, resembling a mushroom, top lifted above leaf surface on a stalk which extends into the mesophyll. Surface undifferentiated. Asci in upper four fifths of disk, lower fifth sterile, 4-spored, ovoid, 28 x 21–24 μ, thick-walled, hyaline. Spores hyaline, 18–22 x 7–8 μ, muriform with usually 3 transverse septa and 1, 2 or 3 longitudinal.

On unknown dicotyledonous host. British Guiana, Coverden 8–4–22, No. 818.

The same specimen bears also *Phyllachora* No. 3. The specimens were collected for the *Phyllachora* (Figs. 3, 4), which is relatively conspicuous, owing to its shining black clypeus. The myriangiaceous fungus is dull and is brownish rather than black and slightly smaller than the *Phyllachora*.

The ascoma is mushroom-shaped and has a foot in the center which extends above the leaf surface, so that the ascigerous portion is distinctly superficial, raised, free above the leaf, Figs. 10–14. The foot may extend merely into the mesophyll, Fig. 11, or in older specimens, in more or less disorganized manner, it may reach to the opposite side of the leaf, Fig. 13. It varies in width from 31–265 μ, and is composed of heavy, dark-brown, mycelial threads, which in the upper part run parallel and close. At the bottom of the foot the mycelial arrangement is more irregular, less parallel.

The ascigerous stroma, that part supported above the leaf, is somewhat disc or cushion shaped, 202–561 μ in diameter, and from 109–171 μ in thickness. It is of pseudoparenchymatous structure, composed of hyaline, thin mycelium. The upper surface shows no indication of differentiation into a cortex, though there is differentiation of a basal layer of the ascoma, and the edges of the ascoma are composed of darker, thick-walled cells, Fig. 12. The upper portion of the ascoma bears numerous asci; the riper ones

being nearest the surface, the youngest lower down, while the lower fifth of the stroma is sterile. The apparent double-wall character of the asci mentioned for the last species is also seen here (Fig. 15).

An especially heavy, black mycelium is seen penetrating the palisade cells or mesophyll near the leaf surface at the right and left of the foot and under the shadow of the ascoma which is above the leaf, Figs. 12, 13. In some instances the epidermal cells are packed with this black mycelium, Figs. 10, 11, constituting a true epidermal clypeus. Study of the ascomata of all ages makes it appear probable that there is first a large stromatic development in the leaf, followed later by the emergence of the ascoma, Fig. 11. A fine, hyaline mycelium is seen wandering throughout the leaf at long distances from the original place of the infection.

Myriangina miconiae Stevens & Weedon, sp. nov.

Figs. 5, 16–18

Spots 1–2 mm. in diameter or by coalescence 3–4 mm., gray to white, due to numerous microscopic ascomata. Spot visible from both sides of the leaf; convex above, concave below. Fungus epiphyllous. Stromata erumpent, flat, 28–56 μ high, 74–193 μ wide. Surface not differentiated. Asci usually in a single layer, though not always so, separated by a pseudoprosenchyma, few, small, oval, 21–32 x 18–21 μ, 2–3- or 4-spored, hyaline, thick-walled. Spores 18 x 7 μ, hyaline, slightly larger at one end; 3 transverse septa, one or more longitudinal septa; constricted at the middle septum.

On *Miconia* sp. ind. British Guiana, Tumatumari, 7–11–1922, No. 174; Demerara-Essequibo R. R., 7–15–1922, No. 332. The same specimen bears a species of *Echidnodella*.

The spot viewed from above shows the cuticle wrinkled radially about it for a distance of 3–5 mm. due to the tension caused by the elevation.

In all instances observed the *Myriangina* was associated with, or on a spot where *Echidnodella* was or had previously been. In many instances the *Echidnodella* was found free of the *Myriangina*, while in other cases the *Myriangina* was present in abundance with its ascomata, apparently on the surface of the *Echidnodella*.

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In other instances the spot bore many ascomata of the *Myriangina* with only traces of the *Echidnodella*. From our observation it appears that the *Myriangina* is necessarily associated with the *Echidnodella*, though our sections show that it is really parasitic on the leaf. Probably the lesions of the *Echidnodella* provide the conditions necessary to parasitism. It is probable also that the *Myriangina* breaking through the cuticle causes the *Echidnodella* to flake off, thus explaining the colonies in which this is nearly absent.

The stroma of the *Myriangina* consists of two portions, the ascigerous, flat disk and a slightly developed hypostroma. Both are composed of fine, hyaline mycelium. The hypostroma consists of a very slight stromatic massing of mycelium between the palisade cells, Fig. 16, and of mycelium which wanders to some distance (193 μ) between the cuticle and the epidermis and between the epidermal cells, also to a slight extent intercellularly into the mesophyll. Though the epidermal, palisade, and mesophyll cells that are surrounded by mycelium by their staining reactions give evidence of abnormality of disease, Fig. 16, the mycelium does not appear to enter the cells. In young ascomata the asci are few, 1–4 in a sectional view; in older ascomata as many as eight were seen. Usually the asci are in a single layer at about the level of the normal epidermis, so that they appear to be resting on the palisade cells. Asci are also frequently seen above the level of the cuticle and are rarely found in the intramatricular hypostroma.

This fungus, with the intramatricular stroma of undifferentiated surface, clearly belongs to the Protomyriangiaceae of Theissen and Sydow and to the Elsinoëae, where its muriform spores place it in the genus *Myriangina*, in which but one species *M. mirabilis* (P. Henn.) v. Höhn. on *Lauraceae* is recorded, and that from Brazil. This species (= *Dictyomollisia albido-granulata* Rehm.)[2] differs from ours in many ways.

These three fungi are of rather exceptional interest because of the problematic relationship of the Myriangiales to other fungi, as well as to the comparative rarity of members of this order and consequent lack of information regarding it. In " Die Natürlichen

2 Theissen, F. Fungi riograndenses. Bot. Cent. Beihefte, *27*; pt. *2*. 406. 1910.

Pflanzenfamilien" of Engler and Prantl they are presented in 1896 as Myriangiaceae, by Fisher, as an "anhang" to the Plectascineae, the group then consisting of but one genus, *Myriangium* Mont. & Berk, with but three species; this genus being based on the type species *M. duriaei* Mont. & Berk. The group was characterized by them essentially as with many "Fruchtkörper" in a stroma, asci scattered, spores muriform. In 1917, in the Synoptische Tafeln,[3] Theissen and Sydow recognize the order Myriangiales of Starbäck [4] and place in it 6 families containing 16 genera and some 40 species. Their characterization of the order is a little broader than that given above, in that the fungi are described as immersed or erumpent-superficial; the stroma either colorless of dark, with or without a differentiated outer layer; and no limitation was placed on the spore septation.

It is noteworthy that a great preponderance of the species then known are tropical, with very few from subtropical regions; also that a large number of species are recorded from South America. In 1918 the same authors [5] place the Myriangiales coördinate with the Dothideales and Pseudosphaeriales in the "Dothidiineae."

The three species that we describe are typically of the Myriangiales, in that the asci are produced singly, scattered, and in a stroma. Theissen and Sydow [6] divide the order into two suborders and numerous genera as follows:

A. Fruchtkörper intramatrikal, ohne begrenzte Ausdehnung. Protomyriangieae Theiss. & Syd.
- (*a*) Stroma farblos plektenchymatisch, nach aussen nicht differenziert ..... 1. Elsinoëae.
- (*b*) Stroma farblos plektenchymatisch, durch eine dunkle Klypeus-artige Deckschicht nach aussen abgegrenzt ..... 2. Plectodiscelleae.

B. Fruchtkörper vorbrechend-frei, bestimmt geformt, allseitig differenziert ..... Eumyriangieae Theiss.
- (*a*) Stroma homogen, farblos sklerotial, aussen-nur von schwarzem hartem Schleim überzogen ... 3. Myxomyriangiaceae.
- (*b*) Stroma nicht schleimig inkrustiert, mit differenziert-zelliger Aussenschicht.

[3] Theissen, F. and Sydow, H., Synoptische Tafeln. Ann. Myc. 15: 433, 1917.
[4] Starbäck, Bihang k. Sv. Vet. Akad. Handl., 25 III, 37, 1899.
[5] Theissen, F. and Sydow, H. Vorentwürfe zu den Pseudosphaeriales. Ann. Myc. 16: 6, 1918.
[6] Theissen, F. & Sydow H., l.c.

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I. Intertheziales Stroma zellig.
  1. Schläuche mehrreihig ..... 4. Myriangiaceae.
  2. Schläuche einreihig ..... 5. Saccardiaceae.
II. Intertheziales Stroma paraphysenartig ..... 6. Dothioraceae.

Our three species agree in having muriform spores and in that they possess a more or less richly developed intramatricular stroma and mycelium, and that on the exposed outer surface there is no differentiated cortical layer. These latter characters lead us to place all three in the suborder Protomyriangiaceae Th. & Syd. and in the family Elsinöeae.

Theissen and Sydow in their key for separation of this order into suborders, and in their discussion of the characters of the families, lay particular emphasis on the statement that the Elsinöeae are devoid of a differentiated surface layer, while the Plectodiscelleae have such. This distinction, so far as the Plectodiscelleae is concerned, is fully borne out by a study of the figures and descriptions of the two species of that group. The wording of their key also calls, in the Eumyriangieae, for an erumpent ascoma with differentiated surface. None of our three species is differentiated on the surface, while two of them only are erumpent, thus seemingly excluding all of them from this suborder. The only remaining family for consideration is the Elsinöeae, characterized by lack of surface differentiation, thus agreeing with all our forms, but also characterized by an innate ascoma. The application of this character would admit one of our species, specimen No. 174, but would exclude both of the others, which are distinctly erumpent-superficial. Thus, under the present systems of classification, two of these fungi are without adequate family. All three of our fungi agree so closely in spore characters, in having an indefinite, undifferentiated surface, in mycelial characters, and in having the asci at several levels, that it appears to us that they are genetically closely related, and that to place them in separate families or suborders would do violence to the natural relationships. If all are to be placed in one family, it must be in the Elsinöeae, with which family they are most closely related in the general summation of their characters. To admit these fungi into the Elsinöeae, the description of the family must be emended to include erumpent

forms, making the distinctive character the undifferentiated surface.

The asci in two of these species, viz., *Myrianginella Tapirae* and *Kusanoopsis guianensis,* show a peculiar structure, in that when the ascus wall is ruptured the ascospores issue, bound together as though still in an ascus, Figs. 9, 15. Whether the spores are still enveloped in a wall is not certain. If so, they present the rare condition among ascomycetes of an ascus with double walls. Perhaps the condition can be explained by assuming that the epiplasm in the ascus is present in quantity, and that it is the epiplasm that holds the spores together, simulating an ascus in appearance. Study of the figures and descriptions given of other Myriangiales, and study of other species, shows that this ascus character is quite common in this group, perhaps indeed it is characteristic of it. Miles,[7] describing *Myriangium tuberculans,* says:

"Each locule is lined with a thick, hyaline sheath, inside which occurs a single ascus. When the stroma is crushed and examined under the microscope, this sheath easily separates from the tissue of the stroma and remains about the ascus, giving the appearance of being merely a very thick ascus wall. If the sheath becomes ruptured, however, the ascus immediately expands, chiefly in a longitudinal direction, often to two or two and one half times its original length, becoming oblong, broadly spindleform, or ovate with blunt rounded ends, while the ruptured locule sheath collapses about its base. The ascus wall is quite thin as compared with this sheath."

Millard presents, as figured by Fisher,[8] an ascus with similar appearance and refers to an "innern Membranschicht." Asci with two walls are mentioned and figured by De Bary[9] as occurring in *Sphaeria* and *Pleospora.*

As stated above, the Myriangiales have recently been grouped with the Dothideales. The genus *Kusanoopsis,* in the possession of the clypeus, shows distinct affiliation with Dothideales, as it does also in the dark stromatic border of the ascoma within the host tissue. The two other species show no distinctive dothidiaceous characters, though they do not disagree with some of the genera now included in the Dothidiales in stroma characters.

[7] Miles, L. E., A New Species of *Myriangium* on Pecan, Mycol. **16**: 77, 1922.
[8] Engler and Prantl, Die Natürlichen Pflanzenfamilien **1**: *pl. 1.* 320.
[9] Comparative Morphology and Biology of the Fungi, Mycetozoa and Bacteria, pp. 93, 95. Trans. by Garnsey, 1887.

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EXPLANATION OF FIGURES

PLATE 18

Fig. 1. Photograph of a leaf showing both *Myrianginella Tapirae* and *Endodothella Tapirae* × 1.

Fig. 2. The two above named fungi enlarged are shown, but even at this enlargement are practically indistinguishable.

Fig. 3. Photograph of a leaf showing *Phyllachora* and *Kusanoopsis guianensis*. Leaf somewhat reduced.

Fig. 4. Photograph showing four stromata of *Kusanoopsis*, much enlarged.

Fig. 5. A portion of the leaf enlarged showing colonies of *Echidnodella* with *Myriangina Miconiae*, much enlarged.

PLATE 19

Figs. 6–9. *Myrianginella Tapirae*

Fig. 6. A single ascoma, with the opening hypophyllous, showing the extension of the ascoma above the leaf, the asci, the lateral and basal border of dark mycelium, the basal clypeus, the space between this clypeus and the basal dark layer, also the diseased palisade cells and mycelium invading the host to considerable distance from the ascoma.

Fig. 7. A double ascoma showing the extension above the leaf surface, the asci, the median region relatively devoid of asci and the irregular bordering of dark mycelium.

Fig. 8. A large flat ascoma.

Fig. 9. An ascus showing shape, heavy wall, and spores; also an ascus ruptured showing two walls.

Figs. 10–15. *Kusanoopsis guianensis*

Fig. 10. A young ascoma, and its supporting stroma.

Fig. 11. Detail of ascigerous region shown in fig. 12, showing lack of surface cortex and the presence of basal and lateral differentiation.

PLATE 20

Fig. 12. Ascoma arising from an epidermal clypeus.

Fig. 13. Section of a stroma showing location of the asci, the foot extending to opposite side of the leaf, and the intramatricular mycelium.

Fig. 14. Diagram showing ascomata on leaf, clypeus, foot, and intramatricular mycelium.

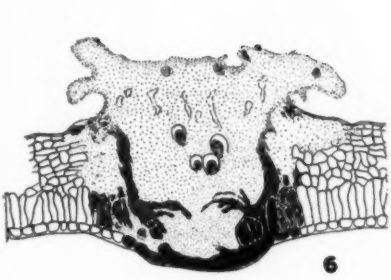
Fig. 15. Asci and spores; also two drawings showing the ascus wall ruptured and the ascus-like body containing the spores emerging.

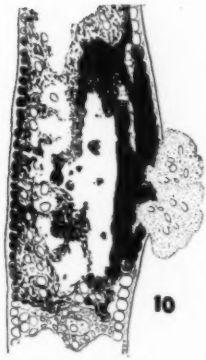
Figs. 16–18. *Myriangina Miconiae*

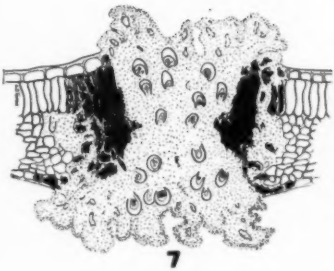
Fig. 16. Section of an ascoma showing it erumpent through the cuticle, the asci, mainly at one level but some between the host cells; the intercellular hypostroma and mycelium subcuticular and between the epidermal and other cells.

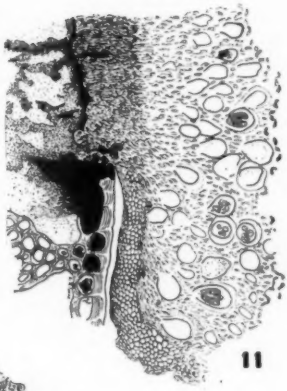
Fig. 17. Three asci showing shape, thick wall and number of spores.

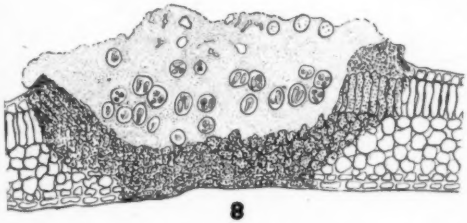
Fig. 18. A spore showing shape, septation and constriction.











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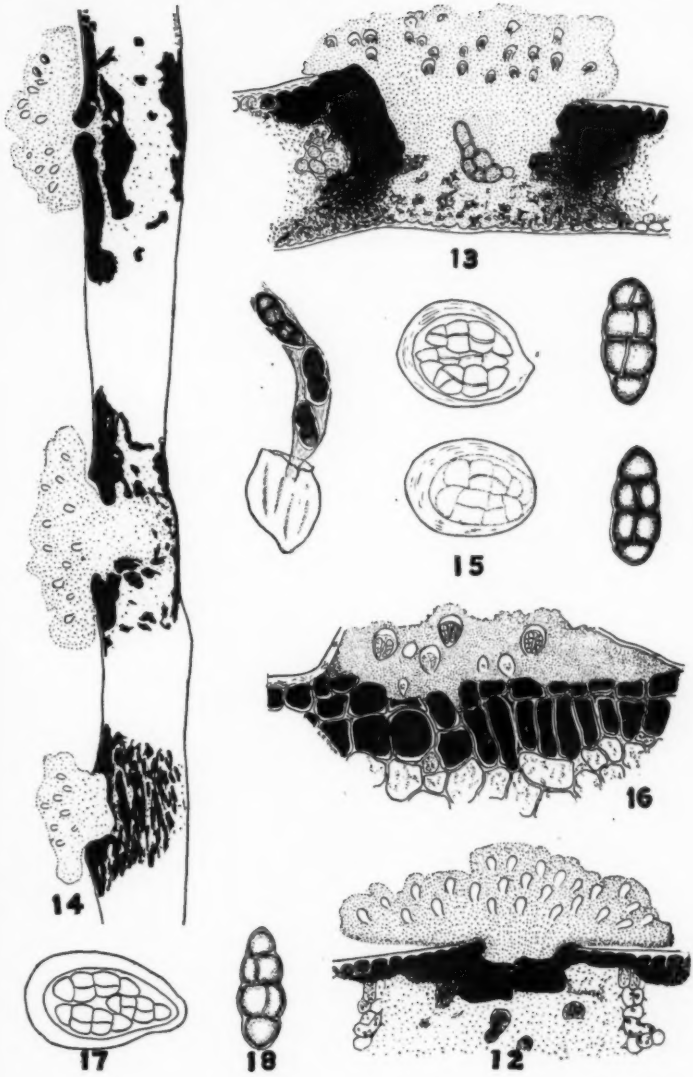

NEW MYRIANGIACEOUS FUNGI

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THE SPECIES OF PORIA DESCRIBED BY SCHWEINITZ[1]

L. O. Overholts

(With Plates 21–24)

In his two major publications on American fungi Schweinitz described a total of twenty-two species of resupinate polypores referable to the genus *Poria*. Many of these were described under the generic name of *Boletus* and most of them were transferred to the genus *Poria* by Cooke.

Of these twenty-two species described as new to North America, seventeen are represented by the type collections in the herbarium of Schweinitz. This herbarium came into the possession of the Philadelphia Academy of Natural Science on the death of Schweinitz in 1834 and is still preserved by that institution. The specimens were mounted in their present condition by Ezra Michener about 1855–57, and much of the material was divided at that time, the second part going into the Michener Collection which is preserved in the Mycological Herbarium at Washington, D. C. Other specimens from the Schweinitz Herbarium are said to be preserved at Kew, at Harvard, at Upsala, and in other herbaria.

During the summer of 1921 I spent several days in study of the material at Philadelphia, and in February of this year revisited the collection. I have not studied the material in the Michener Collection, but it contains nothing that is not represented at Philadelphia.

The photographs of the type collections presented here are mostly enlarged to a uniform magnification of one and a half diameters, since this magnification was necessary to bring out the pores of the smallest pored forms. The micro-photographs are all made from free-hand sections and the lack of a uniform excellence in them is due to the fact that type material of this sort is

[1] Contribution from the Department of Botany, The Pennsylvania State College, No. 43.

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too valuable for future reference to admit of its being depleted more than is absolutely necessary in an attempt to secure sections that can be photographed under the microscope.

I desire to express my appreciation to the following individuals for courtesies extended and assistance rendered in the preparation of this paper: To Dr. F. D. Kern and the Pennsylvania State College for financial assistance in prosecuting the work; to Dr. W. G. Stone and Dr. F. W. Pennell, of the Philadelphia Academy of Natural Science, for access to the Schweinitz Herbarium and for working facilities in making the studies here recorded; to Mr. W. W. Diehl, of the Office of Mycological Collections at Washington, on whom I have relied for my information as to the contents of the Michener Collection; and to Miss Nell Horner, Assistant Librarian at the Missouri Botanical Garden, for assistance in checking up references and looking up citations in publications not easily accessible to me.

PORIA CANDIDISSIMA (Schw.) Cooke, Grevillea **14**: 109. 1886

Polyporus candidissimus Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. effusus; membrana tenuissima, bombycina, sed tamen detrahenda. Ad Polystictus pertinere videtur, sed membrana detractabilis obstat.

Rarior ad ligna putrida. Bethlehem.

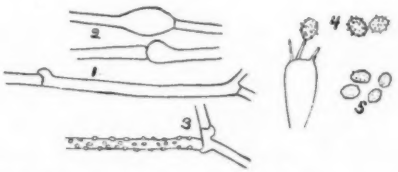
Notes: Only a meager remnant, scarcely one square centimeter, of the type of this species is preserved at Philadelphia. Additional specimens are in the Michener Collection. It is a very thin arachnoid plant, pure white in color when fresh, and soft and flocculent to the touch. The pores are not well developed, but are scarcely more than discontinuous reticulations. Aside from the very thin and delicate fructification the plant has two microscopic characters that are unique and make it recognizable. These are nearly globose, hyaline, *echinulate* spores that measure 2.5 to 4 μ diameter, and the hyphae that occasionally are swollen on one side of a cross-wall to a diameter of 6 to 8 μ. These hyphae are in part minutely incrusted with small crystals and have cross-walls and clamp connections.

I have been familiar with this plant for some time and had kept

it in my herbarium since 1916 without a valid name. In preparing for publication my paper on the Peck Porias I found at Albany one or more collections of the same plant under the manuscript name *P. merulioides* Peck. I adopted this as a herbarium name, although later in referring to Romell's Hymenomycetes of Lapland and to Egeland's Norsk. Res. Poresv., in both of which was described what seemed to be my plant under the name *P. hymenocystis* Berk. & Br., with *P. subtile* as a synonym, I came to the conclusion that my plants should be referred to that species. *P. hymenocystis* is antedated by the present Schweinitzian name. The original brief description of *P. subtile* agrees in most respects and has been used by Bresadola for this plant, yet there are one or two discrepancies that make the use of this name more or less inadvisable. I feel, therefore, that the use of the name *P. candidissima* is conservative practice and can not be criticized from any other standpoint.

A study of the half dozen collections in my own herbarium has yielded the following additional data concerning the species:

The remnants of the Schweinitzian plant (Pl. 21, fig. 1) represent a thin form of the species, which I can match very exactly in collections that contain also much thicker specimens, up to 1.5 mm. (Pl. 21, figs. 2–3). Most of this additional thickness is composed of additional tube lengths, and as the fungus frequently grows in very oblique situations the tubes may appear to be much longer (Pl. 21, fig. 3). The color of fresh specimens is pure white, becoming somewhat yellowish in the herbarium, but usually showing a thin white myceloid sterile margin.



FIGS. 1–5. 1. Hyphae showing branching and clamp connection, from the type specimen of *P. candidissima*; 2. Hyphae from the type collection, showing inflated hyphae; 3. Partially incrusted hypha; 4. Basidium with spores as seen under the oil immersion lens; 5. Spores as seen under ordinary high power magnification.

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Cystidia are absent from the hymenium (Pl. 21, fig. 4) and the roughness of the spore wall is in some specimens only indistinctly visible with the high power of the microscope, but comes out well under the oil immersion lens. Vertical sections of the hymenium show that the trama is rather highly crystalline in composition (Pl. 21, fig. 4), and the subiculum next the tubes shows rather heavily incrusted hyphae. No horizontal layer next the substratum is present, nor is there any other marked structural character in this region.

In microscopic features the plant has great similarity to thin lacerate specimens of *Poria radula,* from which coniferous wood collections seem separable on the basis of habitat, while the spores are a constant diagnostic character.

Redescription: Annual, thin, at first in suborbicular patches, flocculent or membranous, only a few centimeters in extent, up to 1 mm. thick, separable from the substratum, but fragile and easily tearing when fresh, with a well-developed, membranous, white mycelioid margin that may in part disappear; subiculum papery thin, white, inconspicuous; tubes unstratified, less than 1 mm. (usually less than 0.5 mm.) long, frequently in oblique situations and with the mouths gaping and becoming lacerate or even irpiciform in spots, pure white when fresh, usually yellowish on drying, averaging 3 to 4 per mm. or somewhat confluent and 2 per mm.; the dissepiments thin and finely ciliate; spores subglobose or broadly ellipsoid, echinulate, hyaline, 2.5–4 μ; cystidia none; trama and subiculum fairly compact, the hyphae hyaline, somewhat branched, thin-walled, with rather inconspicuous cross-walls and clamps, diameter 2–3.5 μ, occasionally with a bulb-like enlargement next a cross-wall, those in the trama and in a layer of the subiculum next the tubes rather heavily incrusted.

On bark or wood of deciduous or coniferous trees, recorded from *Acer* and from *Tsuga.*

Specimens Examined: North Conway, N. H. (two collections); Catskill Mts., N. Y. (in Herb. N. Y. State Museum as *P. tenellus* B. & C.); New York (Herb. N. Y. State Mus., as *P. merulioides* ined.); Angeles Forest, Calif. (two collections, Pomona College Herb. 1503, 1504); also specimen from Sweden, communicated by L. Romell.

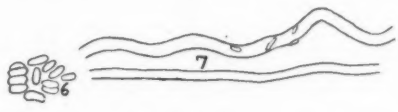
PORIA CARYAE (Schw.) Cooke, Grevillea **14**: 111. 1886

Polyporus caryae Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. junior tuberculoso-elevatus, interruptus, substantia spongiosa-tomentosa, margine sterili saepe tumido. Demum late effusa magis aequalibus et subindurescens, margine tunc tenuissimo, submembranaceo, candido, praeditus. Tubis brevibus, parietibus crassiusculis, poris minoribus subrotundis et subflexuosis; interdum regulariter effusis, interdum pulvinatim in tuberculas elevatis. Ex fuliginis cinerascit. Ad pedalem longitudinem sub trunco effusus. In jacente trunco *Caryae albae* Nazareth, longissime effusus polymorphus.

Notes: The types at Philadelphia consist of two specimens, one measuring 4 by 3.5 cm. (Pl. 22, fig. 1) and the other about 2.5 cm. square (Pl. 21, fig. 6). Specimens from the type collection are also preserved in the Michener collection at Washington. The plants are entirely resupinate, the one with a narrow tomentose margin and the other with an indeterminate margin. The smaller specimen has a very irregular hymenium with elevated rounded tubercles, due, I think, mostly or entirely to irregularities of the substratum. The tubes are short and the mouths avellaneous to pinkish buff in color at present, though they probably were white when fresh. Spores are present in abundance in both specimens and have a tendency to cohere in groups of twos and threes as in *P. corticola.*

I have gone over my *Poria* material rather carefully in the hope of finding some collection referable to this species through which its characteristics might be more completely described, but to no avail. Murrill (Mycologia 13: 99. 1921) records it as having been found in Ohio by Morgan; in Ontario, Canada, on beech;



FIGS. 6–7. 6. Spores from the type specimen of *P. caryae,* showing their coherence; 7. Hyphae of *P. caryae*

from Maine; and from Kansas. I have seen none of these specimens. Mr. Lloyd's published suggestion that it may be close to *P. subacida* Peck is without foundation. It appears to me to be closer to *P. corticola* than to any other species, yet the spores (text

fig. 6) seem not to be quite comparable. They are considerably narrower, inclined to be subcylindric and sometimes curved on one side, measuring 4.5 to 6 by 2.5 to 3 μ. Neither are the hyphae comparable (text fig. 7), not possessing the abundant and conspicuous cross-walls of *P. corticola*. Cystidia are present in that species, but I find no trace of them here (Pl. 22, figs. 2, 3). The following description is based entirely on the type material at Philadelphia.

Redescription: Annual, rather widely effused, inseparable (?), at first with a narrow tomentose margin that may disappear; subiculum thin but evident, white; tubes unstratified, 1–2 mm. long, the mouths now avellaneous to pinkish cinnamon though probably gray, white, or sordid when fresh, angular or subrounded, 3–4 per mm.; dissepiments thin but entire; spores oblong or short-cylindric, smooth, hyaline, 4.5–6 x 2.5–3 μ; cystidia none; hyphae flexuous, simple, no cross-walls or clamps, the walls sometimes more or less scabrous, 2.5–4.5 μ diameter.

On rotting wood of *Carya alba*. Nazareth, Pa.

CINERASCENS

Boletus cinerascens Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. membranacea separabilis subtus fusca subhirta expansa confluens, margine involuto poris majusculis obliquis cinereis.

Rarus ad latera truncorum. Papyraseus, a ligno separabilis; margine sterili, involuto, orbiculato confluens.

No specimens are preserved under this name either in the Schweinitz herbarium or in the Michener collection.

PORIA CINEREA (Schw.) Cooke, Grevillea **14**: 111. 1886

Polyporus cinereus Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. longissime effusus, angustatus, albomarginatus et effiguratus, margine tenui subfimbriato nec tamen byssino. Tubis obliquis brevioribus, poris angustis, subflexuosis. Longitudine 4–6 unciali, 0.5–1 unciali latitudine. Totus unicolor, eleganter cinereus.

Passim Bethlehem ad ramos emollitos. Liriod. et Jugl.

No specimens exist either in the Schweinitz herbarium at Philadelphia or in the Michener collection at Washington.

CROCEUS

Boletus croceus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 96. 1822.

Schweinitz later referred (Trans. Am. Phil. Soc. **4**: 158. 1832) this species to *Poria nitida*. No types are preserved at Philadelphia and none are in the Michener collection.

PORIA DECOLORANS (Schw.) Cooke, Grevillea **14**: 113. 1886

Polyporus decolorans Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. minutis 3–4 lin. diametro, sed longe lateque confluens, non effusus, sed quasi totaliter affixus, margine inflexo, libero, membranaceo. Primum molluscul̃us, albus, decolorans ac sordide brunneus devenit. Poris magnis subflexuosis, e forma orbiculari in flexuosam confluit. Tenerrimus.

Rarior bethlehem in cortice dejecto.

Notes: The type material of this species preserved at Philadelphia is very meager, scarcely covering one square centimeter of area, and I did not secure a photograph of it. I am informed that the co-type specimen in the Michener collection is also quite unsatisfactory. Not much aside from microscopic characters can be added to the original description. The macroscopic features seem to be the white color of the fresh hymenium, becoming darker on drying. The microscopic characters include globose hyaline spores of a diameter of 4 to 5 μ (text fig. 9) and nearly simple hyphae with very occasional cross-walls but no clamps, and large in size, running to 5 to 6 μ diameter (text fig. 8); also heavily incrusted projecting cystidia, best developed in the bottom of the tubes and except on very careful examination likely to be passed by as irregular crustals (text fig. 9; Pl. 22, fig. 4). Their diameter is 7 to 10 μ.

FIGS. 8–9. 8. Hyphae from the type collection of *P. decolorans;* 9. Portion of hymenium of *P. decolorans,* showing spores and the incrusted projecting cystidia.

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Lloyd has stated that the plant seems to be close to *P. sanguinolenta* A. & S., but I do not judge it to belong to the bright-colored series, unless possibly it be related to *P. rixosa* Karst., which, however, has different spores.

The fungus was growing on a piece of bark and from an examination I am unable to state whether it belongs to a hardwood or an acerous host.

Redescription: Annual, effused in elongated confluent patches, inseparable; subiculum membranous, distinct though thin, pallid; tubes unstratified, very short, white and soft when fresh (fide Schweinitz), discoloring to dirty brown on drying, the mouths angular, thin-walled, entire, averaging 4–5 per millimeter; spores globose, smooth, hyaline, 4–5 μ; cystidia present, heavily incrusted, some imbedded and some projecting somewhat, diameter 7–10 μ; hyphae flexuous, with a staining content, somewhat branched, with occasional cross-walls but no clamps, 5–6 μ diameter.

On fallen wood. Bethlehem, Pa. Not otherwise known.

PORIA FAVESCENS (Schw.) Cooke, Grevillea **14**: 113. 1886

Polyporus favescens Schw. Trans. Am. Phil. Soc. II. **4**: 158. 1832.

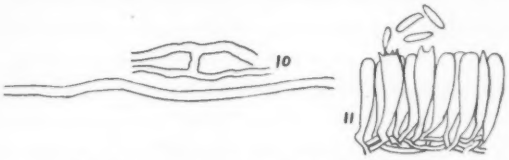
Original Description: P. resupinato-effusus ad pedalem longitudinem, crassus, margine tenui subalbido, determinatim elevato ambitu. Poris latiusculis, hexagonis; tubis longissimis, pallidis.

Non absimilis *P. megalosporo*, Pers. Myc. Eur. 105, differt colore.

Bethlehem rarius in ramis. Favum refert.

Notes: This plant has all the external characteristics of the effused, large-pored type of *Trametes sepium*, as can be seen by a comparison of the two photographs here presented (Pl. 22, figs. 5, 6). The microscopic characters, including spores, size of basidia, and hyphal characters, are exactly as in *T. sepium*, the spores measuring 8 to 9 by 2 to 3 μ (text fig. 11). They were found both free and on basidia. No conspicuous cystidia are in the hymenium (Pl. 22, fig. 7), but an occasional sharp-pointed paraphysis-like body may be found. The basidia are quite large, measuring 6 to 7.5 μ in diameter. The hyphae are long and flexuous, without cross-walls or clamps, rarely branched, and measure 2 to 4.5 μ in diameter (text fig. 10).

It is of interest to note that *T. sepium* was not described until 1847, while Schweinitz's name antedates this by fifteen years.



FIGS. 10–11. 10. Hyphae from the type specimens of *P. favescens;* 11. Basidia and spores from the types of *P. favescens.*

Consequently the priority rule would give preference to the Schweinitzian name, if strictly adhered to. Whether it is wise to attempt to displace old-established names may well be doubted.

PORIA INTERNA (Schw.) Cooke, Grevillea **14**: 109. 1886

Polyporus internus Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. longitudinaliter penetrans in cavitatibus trunci putridi varie flexuosus ad 3–4 uncias, primo molliusculis, crassus margine demum inflexo. Tubis saepe obliquis longioribus. Poris flexuosis minutis. Color totus albus, nisi statu sicco subpallescit.

Bethlehem passim interiori parte truncorum obvius.

No specimens of this species are preserved either in the Schweinitz herbarium or in the Michener collection.

PORIA JUGLANDINA (Schw.) Cooke, Grevillea **14**: 110. 1886

Boletus juglandinus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. durissima immersa compressa difformis, margine sterili involuto spadiceo-cinerea, poris minutis.

In duris truncis Juglandis nigrae et Platani rarior, fissuris ligni immersus margine involuto, ita ut fere pileum efficiat. Pori obliqui, primo obtutu cinerei, demum subspadicei, nitentes.

Notes: The type of this species is preserved only at Philadelphia and is a small immature specimen that evidently grew on the vertical face of its substratum. Hence the tubes are nearly vertical and very poorly developed. In cross-sections of the tubes the hymenium is only partially developed. No spores were seen on basidia, but a few broadly ellipsoid or globose ones were found free floating in the preparations. A few scattered setae are pres-

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ent, however, though they are quite rare. Never more than one showed up in any tube section and many tubes showed none at all. They are of the type of those of *Fomes igniarius,* being dark colored, rather thick and short, and tapering to a rather conical point (Pl. 23, fig. 1).

The context is brown in color and the plant is hard and firm, with a grayish hymenium. Undoubtedly it represents a resupinate condition of some *Fomes,* but the material is too fragmentary for further reference, and too fragmentary to be photographed.

LILACINUS

Boletus lilacinus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 100. 1822.

Original Description: B. P. minor, poris aut cupules magnis flexuosis superficialibus tomento tenui concolori innatis.

Haud rarus in putridis lignis autumno. Unciam longus, totus lilacinus cum proximo medium locum tenet inter Porias et Pezizus.

No specimens of this species are preserved either at Philadelphia or at Washington.

PORIA NIGROPURPUREA (Schw.) Cooke, Grevillea **14**: 110. 1886

Boletus nigropurpureus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. coriaceae effusa durissima, margine inflexuo sterili albescente, poris minutis flexuosis atropurpurascentibus.

Sub truncis *Quercus* rarior, ulna saepe major. Ligneus fere, late effusus.

Notes: The types are all preserved at Philadelphia and include about 2 square centimeters of fungous growth (Pl. 23, fig. 2) fairly well preserved. The general appearance of the plant is of the resupinate condition of *P. adustus,* or following the clue of "atropurpurascentibus" in Schweinitz's description it might be more similar to *P. dichrous,* a species which even in well-developed specimens is sometimes confused with *P. adustus* and *P. fumosus.* The color of the hymenium is now deep mouse gray, and the pores are quite small, averaging 5 to 7 per millimeter, with entire dissepiments. The spores are quite different from those of any of the species named above. They are cylindric (text fig. 12) and measure 5 to 7 by 2 to 2.5 μ, and are plainly to be seen attached

to basidia. There are no cystidia in the hymenium (Pl. 23, figs. 3, 4). The hyphae have inconspicuous cross-walls and clamps and measure 3 to 4.5 μ diameter (text fig. 12). They are rather thick-walled, but the wall is so colorless that this point is not easily made out, though it can readily be seen in the very compact tissue composing the trama as seen in cross-sections of the hymenium.

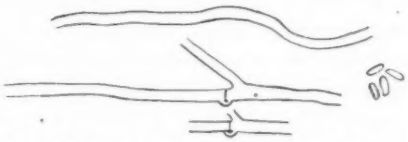


FIG. 12. Hyphae and spores from the type specimen of *P. nigropurpurea*.

The types of this species were collected in North Carolina, but Schweinitz recorded it (Syn. N. Am. Fung. No. 439) also as occurring not infrequently in Pennsylvania. I have seen nothing which I could refer to this species.

Redescription: Annual, apparently separable, without sterile margin; subiculum thin but conspicuous, white, contrasting rather strongly with the dark hymenium; tubes about 1 mm. long, the mouths smoke-colored or deep mouse gray, minute, averaging 5–7 per millimeter, the dissepiments rather thin but entire; spores short-cylindric, hyaline, smooth, 5–7 x 2–2.5 μ; cystidia none; basidia 4–6 μ diameter; hyphae flexuous, hyaline or nearly so though in sections of the trama with a brownish coloration, occasionally branched, with scattered cross-walls and inconspicuous clamps, diameter 3–4.5 μ.

On trunks of *Quercus*. North Carolina, and reported by Schweinitz as occurring also in Pennsylvania.

PORIA PAPYRACEA (Schw.) Cooke, Grevillea **14**: 111. 1886

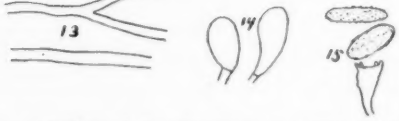
Boletus papyraceus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. membranacea tenuissima sicca adnata candida, poris maximis obliquis pallidis.

Praesertim incolit Vites emortuas. Membrana omino refert Racodium papyraceum. Margine sterilis; in longitudinem expansus.

Notes: The types at Philadelphia cover about three fourths of the upper surface of a bit of wood 5 by 2 cm., and show the fungus

to be a thin white soft species (Pl. 23, fig. 5) comparable to most collections referred to *P. vaporaria* in American herbaria. A narrow white villous margin surrounds the growing edge of the fungus. The fungus seems to be separable from the substratum, and consists of very short pores on an extremely thin white subiculum. Sections of the hymenium show an abundance of cylindric hyaline echinulate spores (text fig. 15). Wall markings of this type constitute a character rarely seen in Porias and yet more rarely found in *Basidiomycetes* with elongate spores, outside of the genus *Clavaria*. Failure to find these spores on basidia has led to the suspicion that they may not belong to the species in question. The hymenium shows basidia-like organs (text fig. 14), but none that are spore-bearing, although sterigmata are present on some, and the general relation and orientation of the spores to



FIGS. 13–15. 13. Hyphae of *P. papyracea;* 14. Large basidia-like organs in the hymenium; 15. Two spores as seen along the hymenium and in proximity to the basidia.

the basidia is suggestive that some of them are attached (Pl. 23, fig. 6). The hymenium is so irregular and collapsed that the point is very difficult to substantiate. When I first observed the spores I recorded in my notes that the markings appeared to be arranged in longitudinal lines, but as I view them now, after a year and a half in glycerine, I fail to substantiate the point and they now appear to be more in the nature of very fine spines, so that the spores might perhaps best be described as spinulose. However, their large size (14 to 18 μ long) and spinulose wall make it seem plausible that they are not basidiospores and might well be the spores of a *Clavaria* or other fungus, scattered over the hymenial surface. Cystidia were not found. As seen in vertical sections much crystalline matter is present in the subiculum next the substratum.

The species is somewhat similar in general appearance to *P.*

candidissima, but the pores are larger and I have found no microscopic evidence of their similarity. I have specimens of a *Poria* collected on *Thuja occidentalis* in New York by Dr. H. D. House that have exactly the type of basidiospore represented here, yet microscopically the two are so different that I hesitate to refer the New York collection to this species.*

Redescription: Annual, thin, white, soft, not widely effused, the margin narrow, white, and villose; subiculum extremely thin, white; tubes less than 0.5 mm. long, the mouths white, cinnamon-buff in dried specimens, subcircular to angular, averaging 2 per millimeter; the dissepiments rather thin, entire; spores (?) not seen on basidia, cylindric, hyaline, spinulose, 14–18 x 5–6 μ; cystidia none; basidia 8–10 μ diameter; hyphae straight, mostly simple, no cross-walls or clamps, diameter 3–4.5 μ.

On dead *Vitis.* Carolina. Not otherwise known to the writer.

PORIA PULCHELLA (Schw.) Cooke, Grevillea **14**: 113. 1886

Polyporus pulchellus Schw. Trans. Am. Phil. Soc. II. **4**: 158. 1832.

Original Description: P. resupinato-effusus, superficie inaequali, subplicata, rugosa, ambitu determinatus; margine undulato tumido, substerili. Poris minutis, regularibus, angustatis, tubis subobliquis in rugis superficiei. Totus fungus flavescens, durus, siccus, uncialis.

Rarior Bethlehem, olim *Xanthus* mihi; cortice increscit.

Notes: The type collection at Philadelphia is in good condition and specimens are also preserved in the Michener collection. It is one of the few Schweinitzian species that has been correctly interpreted by subsequent mycologists, though the autonomy of the species as distinct from related things has been questioned. Dr. Murrill [1] includes it as a synonym for *P. medulla-panis* (Jacq.) Pers., and that interpretation makes the species a most variable one.

* Since this paper has been in press Dr. J. R. Weir has reported (Phytopath. 13: 187, 1923) *P. papyracea* on *Chamaecyparis thyoides* from Virginia, and on *Thuja* from Wisconsin and from Michigan, describing for it spores as here recorded. It seems quite likely that the New York specimens referred to above belong here, and possibly the substratum for the type of *P. papyracea* was *Thuja* or may be *Juniperus* rather than *Vitis.* A dead branch of juniper in particular might easily be passed up as *Vitis.*

[1] Mycologia **12**: 48. 1920.

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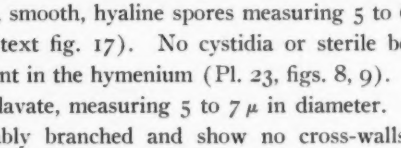
The types are in excellent condition (Pl. 23, fig. 7) and ample enough to show the characters quite well. Microscopically, oblong-ellipsoid, smooth, hyaline spores measuring 5 to 6 by 3 to 4 μ are present (text fig. 17). No cystidia or sterile bodies of any sort are present in the hymenium (Pl. 23, figs. 8, 9). The basidia are broadly clavate, measuring 5 to 7 μ in diameter. The hyphae are considerably branched and show no cross-walls or clamps. Their diameter is 2 to 3 μ (text fig. 16).



FIGS. 16–17. Hyphae from the type of *P. pulchella;* 17. Basidia and spores

These are all characters that apply to the small-pored form of typical *P. medulla-panis,* except that the hyphae there are 2 μ in diameter or less and the plant is hard, and white in color. Yet the two are so closely related that the one grades insensibly into the other, and *P. pulchella* in turn grades over into a yet softer pliable plant in which the hyphae are practically or entirely unbranched and of considerably larger diameter, so that the whole plant approaches *P. subacida* Peck quite closely.

The following brief diagnosis is meant to apply to the type of plant represented in the Schweinitz herbarium. Its relationships with *P. medulla-panis* will be considered in a later paper.

Redescription: Annual or persisting, broadly effused, separable, 1–5 mm. thick, leathery or tough when fresh; subiculum very thin, floccose, white; tubes 1–1.5 mm. long each season, the mouths cream-color to light tan, circular or subcircular, averaging 5–6 per millimeter; spores oblong-ellipsoid, thin-walled, hyaline, smooth, 5–6 x 3–4 μ; cystidia none; basidia broadly clavate, 5–7 μ diameter; hyphae long and flexuous, considerably branched, no cross-walls or clamps, diameter 2–3.5 μ.

On dead wood of deciduous trees. Frequent in eastern United States.

PORIA RHODODENDRI (Schw.) Cooke, Grevillea **14**: 113. 1886

Polyporus rhododendri Schw. Trans. Am. Phil. Soc. II. **4**: 158. 1832.

Original Description: P. longitudinaliter effusus, angustatus. Primum observatur membrana papyracea, detractabilis, albescens aut pallescens, in cujus centro pori pauci parum elevati, lati, occurrunt. Demum poris his, tota superficie obsita est, membrana tantum non in ambitu ubi sublifera et subinflexa. Poris tandem in tubos angulatos, margine fimbriatos, 2–3 lineas altos, ex pallide fuscescentes, elevatis. Totus fungus 1–3 uncias longus, ¼ unc. latus, affinis *P. contiguo*.

Notes: The type collection at Philadelphia consists of a single slab of decorticated wood on which is effused a sporophore 4 cm. long by 6 mm. broad (Pl. 22, fig. 8). Another specimen is in the Michener collection at Washington. Lloyd has recorded the observation (Letter No. 50, note 436, 1913) that this specimen is "surely not what Schweinitz described." I find no evidence to bear out this statement, since there is little in the original description that is contradicted by the specimen. The phrase in the description, "affinis *P. contiguo*," is contradicted by the words "albescens aut pallescens," since *P. contigua* is a brown species.

The species seems undoubtedly to be the same as *Trametes sepium*, as is borne out by the following facts. The subiculum is thin and inconspicuous, but white in color and separable from the substratum, bearing tubes 1 to 1.5 mm. long, the mouths of which are angular, and 0.5–1 mm. in diameter (Pl. 22, fig. 8). The dissepiments are thin and somewhat fimbriate. Sections of the hymenium yielded no spores and no basidia. The hyphae (text fig. 18) are of two general types: (*a*) large, simple, hyaline, unstaining filaments which show no cross-walls or clamps and have a

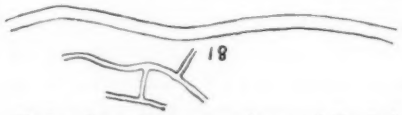


FIG. 18. Hyphae from the type specimens of *P. rhododendri*.

diameter of 3 to 5 μ; (*b*) small, considerably branched, heavy-staining hyphae on which no cross-walls or clamps are visible and of which the diameter is about 2 μ.

These characters are exactly those of *T. sepium*, and so I take Lloyd's opinion that the fungus as now preserved is that species, and without better evidence than seems available I conclude that this specimen is the type from which the description was originally drawn.

The species was originally described as occurring on fallen *Rhododendron* trunks at Salem, N. C.

PORIA SASSAFRAS (Schw.) Cooke, Grevillea **14**: 109. 1886

Polyporus sassafras Schw. Trans. Am. Phil. Soc. II. **4**: 158. 1832.

Original Description: P. substantia molliuscula, fibula; subiculo vix in margine conspicuo; tubis in centro satis elongatis, crassiusculis. Poris minutis, regulariter rotundis. Longitudinaliter in ligno ac cortice effusus (colore pallide lutescente) ad 1–2 uncias.

Passim in lignis carie fere consumptis *Sassafras*, Bethl.

Notes: There is some discrepancy between the description and the specimens preserved at Philadelphia. For example, the term "crassiusculis" can not be applied to the dissepiments nor the term "minutis" to the pores.

FIGS. 19–20. 19. Hyphae from the type specimens of *P. sassafras*, showing abundant branching; 20. Spores of the same.

The plant is thin and not widely effused, covering only 4 or 5 square centimeters of wood area (Pl. 24, fig. 1). No specimens are preserved in the Michener collection. One specimen at Philadelphia has a broadly sterile margin, but the subiculum is not conspicuous, though white in color. The color of the hymenium is now close to straw color or yellowish white. I did not succeed in getting sections of the hymenium suitable for photographing. The spores are broadly ellipsoid, hyaline, and measure 5 to 6 by 4 to 4.5 μ (text fig. 20). There are no cystidia. Some hyphae are greatly branched as in *P. pulchella* and lack cross-walls or

clamps. Some are narrow and rigid with a diameter of 1.5 to 2.5 μ, while others are broader, measuring up to 4 μ (text fig. 19).

Redescription: Annual, probably separable, soft and watery when fresh, at first with a broad sterile border that may disappear with age; subiculum thin, white; tubes unstratified, 1–2 mm. long, their mouths white when fresh, becoming yellowish on drying, rounded to slightly angular, entire, averaging 4 to 5 per millimeter; spores ovoid to broadly ellipsoid, hyaline, 5–6 x 4–4.5 μ; cystidia none; hyphae hyaline, much branched, no cross-walls or clamps, diameter 1.5–4 μ.

On decaying sassafras wood. Bethlehem, Pa.

PORIA SPISSA (Schw.) Cooke, Grevillea **14**: 110. 1886

Polyporus spissus Schw. in Fries' Elenchus Fungorum **1**: 111. 1828.

Original Description: Durissimus, immersus, difformis, cinereospadiceus, margine brevissimo inflexo, poris obliquis minutissimis.

Notes: The description and the specimens at Philadelphia do not well accord, although the plants change much on drying, and it may be that the description was made from the dried plants as Lloyd suggests. But " durissimus " is not a good descriptive term to apply to even the dried plants and the color is not " spadiceus." Fries noted that the description agreed entirely with that of *P. juglandina,* but the types of the two have not the remotest resemblance.

The type at Philadelphia is an admirable little specimen with an apricot buff coloration on the younger parts of the dried specimen, while the hymenium is hazel to carob brown. The tubes have a resinous appearance, but have developed no hymenium. No specimens are preserved in the Michener collection.

FIG. 21. Hyphae from the type of *P. spissa,* one showing the incrusting crystals.

The entire array of characters presented by the plant is that shown by *P. laetifica* Peck, and the name takes precedence over that given by Peck. Murrill has already come to about the same

conclusion, citing in addition four other names coupled with American plants, as synonyms, all antedated by Schweinitz's name. The description previously given of *P. lactifica* in my writings must suffice for the present time.

PORIA SUPERFICIALIS (Schw.) Cooke, Grevillea **14**: 113. 1886

Boletus superficialis Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. tenuis sicca ferrugineo-cinerascens, poris superficialibus latiusculis prominulis sublaceratis subconfluentibus.

In Pruno silbatica emortua, longe lateque repens. Pori tubis fere nullis, nec margine distincti.

Notes: This is a brown species, but, as often shown in related forms, the hymenium has become grayish with age—so much so that at first glance it impressed me as belonging to the white group, the color being smoke-gray to hair-brown. A sterile, seta-bearing margin surrounds on two sides the excellent little type specimen at Philadelphia (Pl. 24, fig. 2). Specimens are also preserved in the Michener collection at Washington. The subiculum is brown and thin. The tubes are about 1 mm. long, brown within, the mouths angular, variable in size, measuring 1 to 3 per millimeter. Setae are rather abundant in the tubes (Pl. 24, fig. 3), but I found no basidia developed in my sections. The setae are strongly projecting and measure 9 to 12 μ in diameter.

FIG. 22. Single hypha from the type specimen of *P. superficialis*.

The lack of spores makes it a little questionable as to the plant's relationships. Schweinitz gives Fries' comment as ". . . vix conjunxisset cum *P. viticola*. . . ." Berkeley reported it as the same as *P. nigropurpureus*, but it is not that plant, having much larger pores and a distinct brown coloration. Lloyd was inclined to accept Fries' idea, with which I agree. It has the larger pores of *P. viticola* rather than of *P. ferruginosa*, the distinction between the two species being otherwise best made on the spore characters, and those are lacking in the Schweinitz plant. The fact that it was reported as occurring on *Prunus* suggests that it might be *Fomes fulvus*, but the characters are not those of that species.

When sections of the hymenium from the type specimens of *P. superficialis* and *P. viticola* are compared microscopically, there is no distinction between them (Pl. 24, figs. 3, 6). The former antedates the latter by some six years, and if these are not antedated by a prior name, *P. superficialis* should be given preference. Quite probably, however, *P. contigua* Pers. is the same plant, and it has been more recently named both in Europe and in America.

PORIA TENUIS (Schw.) Cooke, Grevillea **14**: 114. 1886

Polyporus tenuis Schw. Trans. Am. Phil. Soc. II. **4**: 159. 1832.

Original Description: P. longe longitudinaliter effusus, membranam sistens tenuem subdetrahendam albo-pallentem aequabilem margine substerili albidori. Poris majusculis subflexuosis, parum excavatis pallidis.

Ad fibrosam internam corticem Castaneorum. Bethl.

Notes: The type material at Philadelphia shows well the characters of the plant. Specimens are also to be found in the Michener collection. The fructifications have a length of 3 cm. and a width of 1.5 cm. (Pl. 24, fig. 4). The species belongs to the white group and shows a broadly sterile, white, compactly tomentose margin and a very thin white subiculum. The color of the hymenium is now cartridge buff or pinkish buff. Spore and hyphal characters are as in *P. medulla-panis* (text figs. 23–24).

FIGS. 23–24. 23. Large and small hyphae from the type specimen of *P. tenuis*; 24. Spores of the same.

The fungus is certainly a close relative of the above-named species and probably should take its place in the synonymy of either that plant or of *P. pulchella*. I was unable to secure sections suitable for photographing.

Redescription: Annual, effused in elongated patches, separable, with a broad sterile tomentose margin; subiculum very thin, inconspicuous, white; tubes unstratified, 0.5 mm. long, the mouths white, becoming cartridge buff or pinkish buff in herbarium specimens,

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angular or subrounded, averaging 4 per millimeter; spores ellipsoid or oblong-ellipsoid, smooth, hyaline, 4.5–5.5 × 3–4 μ; cystidia none; basidia broadly clavate, 6 μ diameter; hyphae mostly rigid, much branched, no cross-walls or clamps, diameter 1.5–2.5 μ, a few somewhat larger and more flexuous, up to 3.5 μ diam.

On decorticated wood of *Castanea.* Bethlehem, Pa.

PORIA TULIPIFERA (Schw.) Saccardo, Syll. Fung. **6**: 312. 1888

Irpex tulipiferus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 99. 1822.

Original Description: B. P. maxime effusa margine involuto tenui albida, poris maximis acutis prominulis asperis irregularibus.

Frequens ad truncos emortuos Liriodendri, ad viginti pedes et amplius, saepe arbores integras circumdans, alias orbiculatus confluens, albus, demum pallidus. Pori interdum in formam Sistotrematis porrestic.

No types of this species are preserved either at Philadelphia or at Washington. As generally interpreted it is a common plant, formerly referred to *Irpex,* but a true polypore, often pileate, and now more generally included in *Polyporus.*

PORIA VITELLINA (Schw.) Cooke, Grevillea **14**: 110. 1886

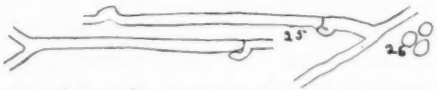
Boletus vitellinus Schw. Naturforsch. Ges. Leipzig Schrift. **1**: 100. 1822.

Original Description: B. P. subexpansa molliuscula, margine byssino, poris magnis elevatis opacioribus.

Rarus fungus in fissuris lignorum, maxine putridorum, nidulat. Color pulcherrime vitellinus, post exsiccationem remanet. Pori molles.

Notes: The type specimens at Philadelphia show very poor material. Others are preserved at Washington. It is apparently a soft yellow species, and the types evidently grew on a vertical substratum. The hymenium is developed only on a small part of the soft extensive subiculum. The former is now orange cinnamon or tawny in color, while the subiculum is cinnamon-buff. The present colors would point to fresh plants having somewhat more red or orange in them rather than egg yellow. The tubes are quite fragile, with mouths averaging 2 to 3 per millimeter. Abundant spores are in the hymenium, but I am of the opinion that they are either chlamydospores or else are foreign to the plant, and they were not found on basidia. They are globose, smooth,

and measure 4 to 6 μ in diameter (text fig. 26). Crushed preparations of the subiculum show an anomalous condition of a few well-developed somewhat branched hyphae, 4 to 4.5 μ in diameter, with very well-formed clamps and cross-walls (text fig. 25). There are present also some very fine hyphae 1 to 2 μ in diameter that probably belong to another organism. I was unable to secure sections suitable for photographing.



FIGS. 25–26. 25. Hyphae from the type specimens of *Poria vitellina*, showing clamp connections; 26. Spores found on the hymenium, but not attached to basidia.

I have a similar plant on coniferous wood that I would like to refer here, but a study of the substratum of the type collection shows that it is unquestionably a hardwood. My plants agree otherwise almost exactly, but the spores are oblong-ellipsoid or slightly reniform and apiculate at one end, and measure 5 to 6 by 3 to 3.5 μ. But the different substratum and the lack of basidiospores in Schweinitz's type make such a reference undesirable at present.

Redescription: Annual, effused, soft, bright colored, consisting of a well-formed soft subiculum on part of whose surface tubes are developed; subiculum egg yellow or becoming cinnamon buff on drying; tubes less than 1 mm. long, oblique, the mouths egg yellow (fide Schweinitz), becoming orange cinnamon or tawny in herbarium specimens, averaging 2 to 3 per millimeter; spores (?) globose, smooth, probably bright colored in mass but hyaline under the microscope, 4–6 μ diameter; cystidia none; hyphae not to be easily differentiated in the type specimens.

On rotten hardwood. Carolina.

PORIA VITICOLA (Schw.) Cooke, Grevillea **14**: 114. 1886

Polyporus viticola Schw. in Fries, Elenchus Fung. **1**: 115. 1828.

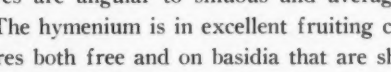
Original Description: Effusus, innatus, glaber, fuscus, poris difformibus, subangulatis, acutis, glabris.

Ad *Vitis* sarmenta. Salemo in Penn. Amer. foed.

Notes: This is a well-known species, but has passed under a

variety of names, of which *Poria contigua* is the oldest. However, no uniformity exists among European mycologists as to the status of *P. contigua*. The types of *P. contigua* Pers. have been studied by Romell, but he reports them as sterile, stating, moreover, that *P. contigua* (Pers.) Fr. is a different (really three different) plants.

The Schweinitzian types are well preserved at Philadelphia and specimens are also in the Michener collection at Washington. The main fructification measures 3.5 by 1.3 cm., and is seated on a slab of decorticated hardwood, said by Schweinitz to be *Vitis* (Pl. 24, fig. 5). The subiculum is a thin brown membrane on which are seated tubes 1 to 2 mm. long and surrounded by a narrow brown rather conspicuous velutinate margin. The hymenium is close to Dresden brown with finely velutinate surface, while the pores are angular to sinuous and average 1 to 2 per millimeter. The hymenium is in excellent fruiting condition with abundant spores both free and on basidia that are short-cylindric, hyaline, and measure 5 to 6 by 2 μ (text fig. 27). Setae are abundant and taper to a long lance-like point, projecting 30 to 45 μ beyond the basidia (Pl. 24, figs. 6, 7).



FIGS. 27–28. 27. Spores from the type of *Poria viticola;* 28. Hypha from the type of *P. viticola.*

Murrill has given a very good description of this species (N. Am. Flora **9**: 4. 1908), except that the spore record is erroneous, and I measure the setae as somewhat larger than 6 to 7 μ diameter. It is by no means confined to *Vitis,* but grows on a great variety of dicotyledonous hosts.

The species grades over into *Trametes tenuis* Karst., a plant widely distributed in the United States and usually found in resupinate condition, but sometimes pileate. I hardly see how it will be possible to keep these two species separate. *T. tenuis* includes longer-tubed and narrower-pored forms than typical *P. viticola,* yet I have one collection from a coniferous host in Colorado that has some specimens that agree exactly with a large-pored

Missouri collection on *Vitis*, while other specimens show longer and narrower tubes characteristic of *T. tenuis*. Professor Romell, of Sweden, also sends me both of these forms under one herbarium name. *T. setosus* Weir is a somewhat intermediate condition between the two, though referable, if there is a specific distinction here, to *T. tenuis*.

While both *P. contigua* Pers. and *P. superficialis* Schw. are in all probability this species and both antedate the name *P. viticola*, yet the absence of spores in the type collections of both plants renders a definite conclusion impossible, and I shall retain the latter name to designate, for the present, our common large-pored brown *Poria* as here described and illustrated (Pl. 24, figs. 5, 8), without the inclusion of the typical *T. tenuis* form, though I find nothing more than arbitrary separation of collections possible. It is a common species, but I have never found typical examples of it on coniferous wood, while both *T. tenuis* and *Poria ferruginosa* are often so found. The last-named species is a close relative, but differs in the long ellipsoid spores and the somewhat different setae, as already described in this series of papers.

The following description is drawn from a wide range of specimens in the writer's herbarium.

Redescription: Annual or persistent, often broadly and irregularly effused but frequently in narrow elongated patches, inseparable, at first with a very narrow tawny pubescent or strigose-pubescent margin that usually persists though becoming more cinnamon in color and more glabrate with age; subiculum very thin, bright rusty brown; tubes unstratified though sometimes persistent, 1–2 mm. long, gray within, the mouths tawny olive to ochraceous tawny at first, finally of a duller color close to snuff brown or with a tinge of buffy brown, angular to somewhat sinuous, rather thin-walled but nearly entire, at first distinctly velutinate with rather coarse hairs, finally more glabrous, averaging 1–3 per millimeter; spores short-cylindric when mature, smooth, hyaline, 6–7 x 2–2.5 μ; setae abundant, visible in the tube walls under a good lens, projecting 25–45 μ, tapering to a long slender point, 7–12 μ diameter; hyphae straight, brown, no cross-walls or clamps, diameter 2–3 μ.

On bark and wood of deciduous trees of *Acer, Hamamelis, Populus, Quercus, Salix, Vitis*, and probably other hosts.

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Specimens Examined: Lake Winnepesaukee, N. H.; Central Village, Conn.; North Spencer and Catskill Mts., N. Y.; Lakehurst, N. J.; Westport, State College, and Stone Valley, Pa.; New Richmond, Mich.; Meramec Highlands and Crêve Coeur Lake, Mo.

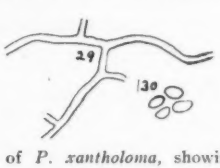
PORIA XANTHOLOMA (Schw.) Cooke, Grevillea **14**: 113. 1886

Polyporus xantholoma Schw. Trans. Am. Phil. Soc. II. **4**: 158. 1832.

Original Description: P. effiguratim effusus, tenuissimus, margine membranaceo fimbriato, latiusculo, sterili, eleganter luteo. Poris superficialibus, parietibus crassiusculis, subsinuosis, minutis, pallidis. Plagas 1–2 unc. irregulares efformat, ligni inaequabilitatem forma sequens.

Rarior occurit Salem ad ligna putrida.

Notes: Specimens of this species are preserved at Philadelphia and at Washington. The former is on a small piece of some large-pored wood like chestnut or oak and the fungus is a thin, hard species of a sordid yellow color close to pinkish buff or light buff. The tubes are not more than one half a millimeter long, the



FIGS. 29–30. 29. Hyphae of *P. xantholoma*, showing branching; 30. Spores of the same.

mouths rounded, averaging about 4 per millimeter and with entire dissepiments (Pl. 24, fig. 9). The spores are ellipsoid to ovoid or oblong-ellipsoid, hyaline, thin-walled, 5 to 6 by 4 μ (text fig. 30). An occasional fusiform sterile organ is present in the hymenium and measures 5 to 6 μ diameter. The basidia are large, 7 to 9 μ diameter. The hyphae are rather rigid, much branched, with no cross-walls or clamps and a diameter of 1.5 to 3.5 μ (text fig. 29). I was unable to secure sections good enough for photographing.

All of the characters are typical of the bright-colored form of *P. medulla-panis*, to which there is no question this plant should be referred.

PENNSYLVANIA STATE COLLEGE, STATE COLLEGE, PA.

EXPLANATION OF PLATES 21–24

PLATE 21

Fig. 1. Photograph, × 1½, of the type specimen of *P. candidissima.*

Fig. 2. Photograph, × 1½, of *P. candidissima* as represented by no. 4581, Overholts Herb.

Fig. 3. Photo, by 1½, of *P. candidissima* as represented by no. 4609, Overholts Herb.

Fig. 4. Micro-photograph, × 320, of a portion of the hymenium of *P. candidissima* as represented in Overholts Herb. no. 5972.

Fig. 5. Micro-photograph, × 160, of the cross section of the hymenium of *P. candidissima,* Overholts Herb. 5972.

Fig. 6. Photo, by 1½, of one portion of the type specimen of *P. caryae.*

PLATE 22

Fig. 1. Photo, × 1½, of a second portion of the type specimen of *P. caryae.*

Fig. 2. Micro-photograph, × 320, of a small portion of the hymenium of the type specimen of *P. caryae.*

Fig. 3. Micro-photograph, × 160, of a cross section of the hymenium of the type specimen of *P. caryae.*

Fig. 4. Micro-photograph, × 320, of a vertical section through a single tube of the type specimen of *P. decolorans,* showing a single projecting incrusted cystidium, and in the trama other cystidia seen in section.

Fig. 5. Photo, × 1, of the hymenium of a resupinate specimen of *Trametes sepium* for purposes of comparison with Fig. 6.

Fig. 6. Photo, × 1, of the type specimen of *P. favescens.* Compare with Fig. 5.

Fig. 7. Micro-photograph, × 320, of a small portion of the hymenium from the type specimen of *P. favescens.*

Fig. 8. Photo, × 1½, of the type specimen of *P. rhododendri.*

PLATE 23

Fig. 1. Micro-photograph, × 320, of cross section of single tube of type specimen of *P. juglandina,* showing single seta.

Fig. 2. Photo, × 1½, of type specimen of *P. nigropurpurea.*

Fig. 3. Micro-photograph, × 160, of cross section of hymenium of type specimen of *P. nigropurpurea.*

Fig. 4. Micro-photograph, × 320, of cross section of hymenium of type specimen of *P. nigropurpurea.*

Fig. 5. Photo, × 1½, of the type specimen of *P. papyracea.*

Fig. 6. Micro-photograph, × 320, of the major portion of a vertical section of a single tube of the type specimen of *P. papyracea,* showing the position of the peculiar spores along the hymenium.

Fig. 7. Photo, × 1, of one portion of the type specimen of *P. pulchella.*

Fig. 8. Micro-photograph, × 160, of cross section of the hymenium of the type specimen of *P. pulchella.*

Fig. 9. Micro-photograph, × 320, of cross section.

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PLATE 24

Fig. 1. Photo, × 1½, of portion of the type specimen of *P. sassafras*.

Fig. 2. Photo, × 1½, of the type specimen of *P. superficialis*.

Fig. 3. Micro-photograph, × 320, of a small portion of the hymenium of *P. superficialis*, showing setae.

Fig. 4. Photo, × 1, of the type specimen of *P. tenuis*.

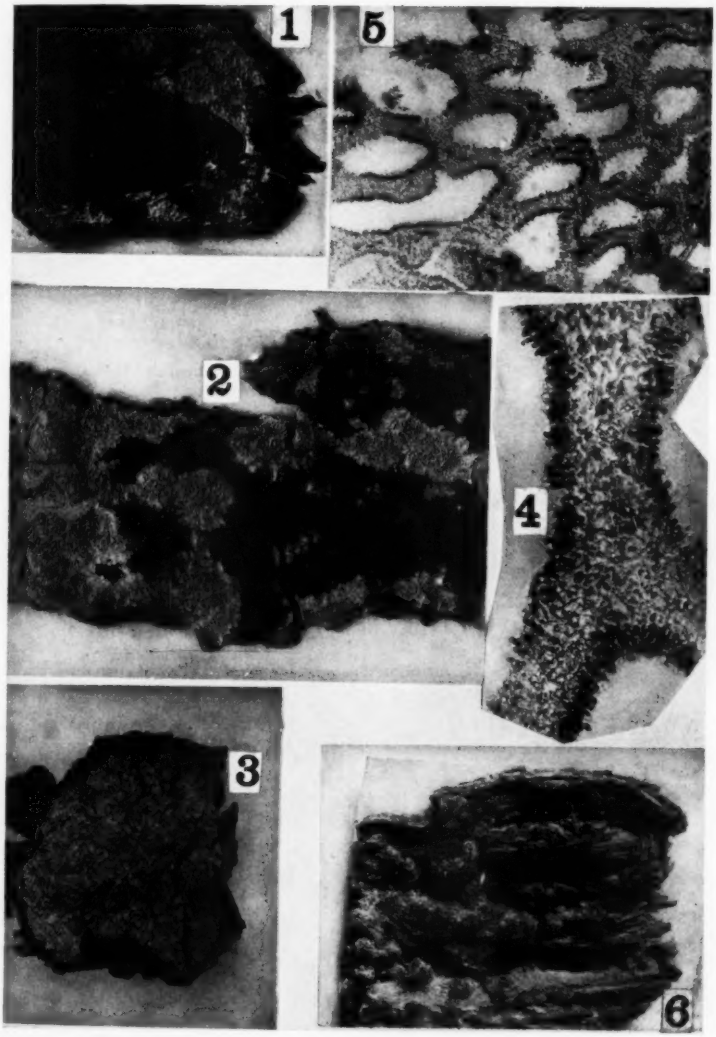
Fig. 5. Photo, × 1, of the type specimen of *P. viticola*.

Fig. 6. Micro-photograph, × 320, of a small portion of a single tube of the type specimen of *P. viticola*.

Fig. 7. Same, as seen under magnification of 160 diameters.

Fig. 8. Specimen of *P. viticola* on *Vitis*, as seen in specimen in Overholts Herb. no. 7530.

Fig. 9. Photo, × 1½, of the type specimen of *P. xantholoma*.



1–5. PORIA CANDIDISSIMA
6. PORIA CARYAE

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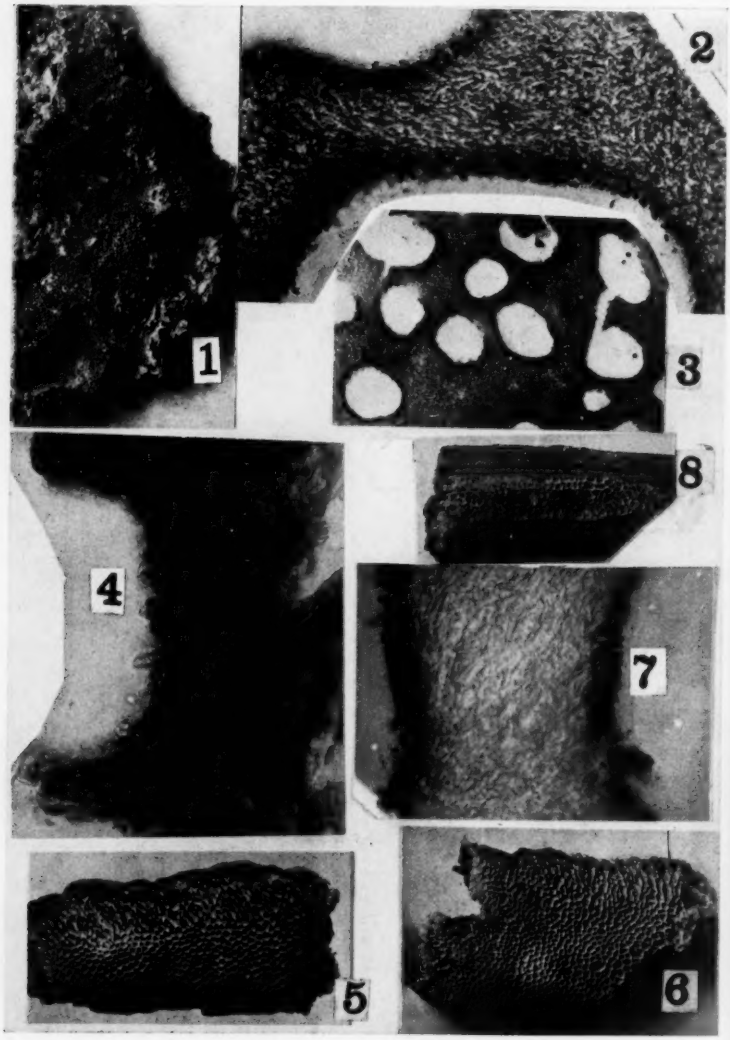
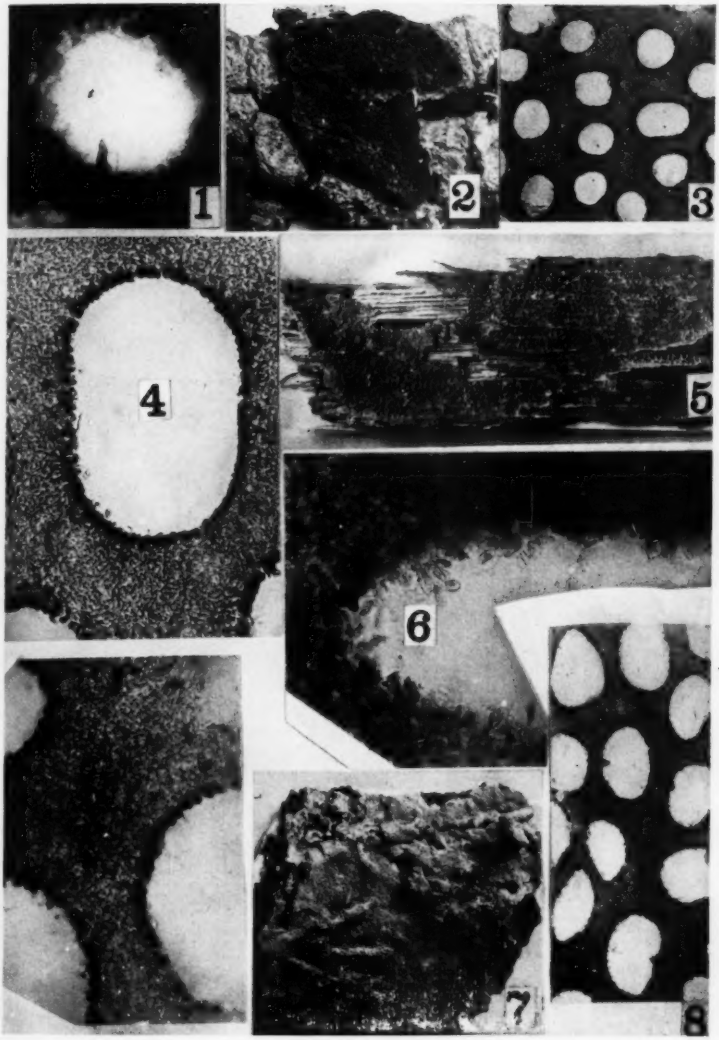


1–3. PORIA CARYAE
4. PORIA DECOLORANS
5. TRAMETES SEPIUM
6–7. PORIA FAVESCENS
8. PORIA RHODODENDRI



1. PORIA JUGLANDINA
2–4. PORIA NIGROPURPUREA
5–6. PORIA PAPYRACEA
7–9. PORIA PULCHELLA

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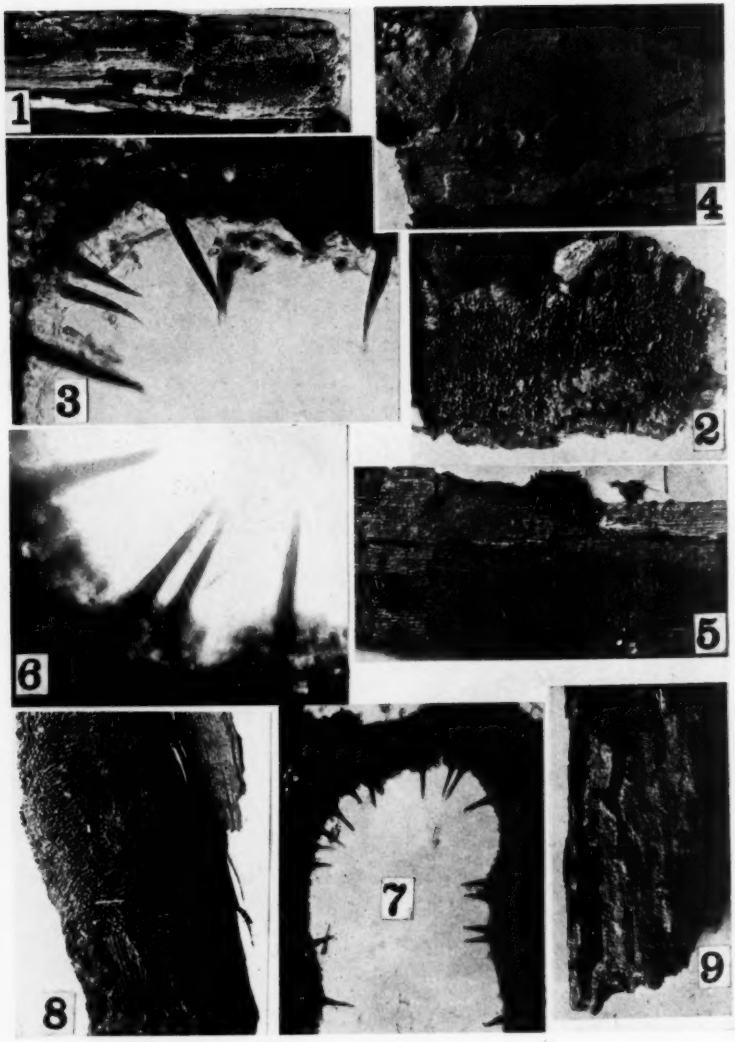

1. PORIA SASSAFRAS
2–3. PORIA SUPERFICIALIS
4. PORIA TENUIS
5–8. PORIA VITICOLA
9. PORIA XANTHOLOMA

THE LIFE HISTORY OF NECTRIA IPOMOEA

MELVILLE T. COOK

(WITH PLATE 25)

This species was first described by the late Dr. Byron D. Halsted, who believed it to be the cause of one of the numerous sweet potato rots. For many years this idea was undisputed, but was finally disproved by Harter and others. The prevailing idea at present is that the fungus is a saprophyte working on a decay which is caused by some organism preceding it. However, it is possible that it may be the cause of slight decay under certain conditions. It is found most commonly on black-rot sweet potatoes, a decay caused by *Sphaeronema fimbriatum* (E. & H.) Sacc. It grows luxuriantly on Cook's No. II medium, producing first a very abundant growth of hyphae, followed by great numbers of perithecia. This study was undertaken to determine the life history of this organism and also in hopes that it might be possible to locate the sexual organs. The medium was used both with and without agar, and the organism was grown in petri dishes, in test tubes, and in hanging drop cultures. The early stages were studied in hanging drop cultures and fragments from petri dish and test-tube cultures.

In the early growth of the fungus the hypha branches luxuriantly, but does not produce septa until considerably later in its development. The formation of the septa and later of the perithecia appears to be stimulated by the diminution of the food supply. The characteristic conidiospores are produced in abundance and well in advance of the formation of the perithecia. They are one- to six-celled, falcate, and extremely variable in size. There appears to be no definite order for the formation of the perithecia. They may originate from one or more than one hypha and in many cases show striking resemblances to the early stages of the Erysiphaceae and Aspergillaceae, but no union of cells or nuclei was observed (figs. 1–19). The variation in these

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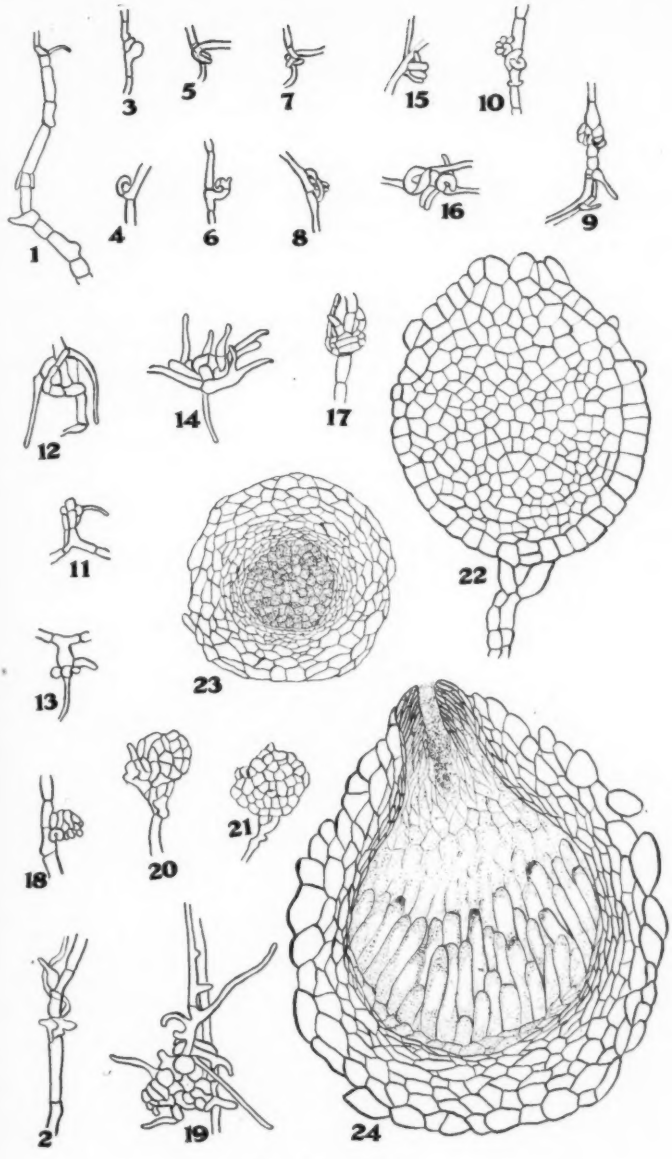
early stages could not possibly be greater. It is practically impossible to find any two that are the same. The massing and tangling of these hyphae is followed by increased growth and by the formation of numerous septa until we have a more or less globular structure which bears a superficial resemblance to the perithecia of the Erysiphaceae without the appendages (figs. 20–21). Cayley [1] also notes this " tangle of coiled hyphae " in *Nectria galligena,* but also failed to recognize an archicarp giving rise to a perithecium. So far as the writer was able to determine, all of these tangled masses of hyphae develop into perithecia, but Cayley states that in *N. galligena* some of them are sterile.

Microtome sections were necessary for a further study of these bodies. At first they were composed of a more or less homogeneous mass of cells throughout, but finally underwent a differentiation resulting in a central mass of thin-walled cells which are very rich in protoplasm and which are followed by several layers of small cells (fig. 23). Cayley claims to have been able to recognize ascogonia in this central mass of thin-walled cells, but the writer was unable to make any such distinction. The rostrum arises from one side of this globular mass and is apparently developed from this central mass of thin-walled cells and pushes its way through the two zones of cells just referred to (fig. 24). The side from which it arises will hereafter be referred to as the upper side and the opposite side as the basal side. The basal side lies next to the substratum. The asci arise from the basal side of the central mass of thin-walled cells—that is, directly opposite the rostrum. The writer was unable to determine their exact origin, but their growth is quite rapid. The mass of thin-walled cells above them gives way and apparently supplies them with food. The asci grow rapidly until the upper ends reach the lower part of the rostrum. The ascospores are mature and escape through the rostrum. Cayley does not describe the rostrum in *N. galligena,* but states that the " ascospores emerge through the raised ostiolum at the apex of the perithecium."

The life history of this species is very similar to that of *Nectria galligena* as described by Cayley, except that the writer failed to

[1] Cayley, Dorothy M., Some Observations on the Life History of *Nectria galligena* Bres., Annals of Botany **35**: 79–92 (1921).



NECTRIA IPOMOEA

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recognize any ascogenous hypha such as has been described by Cayley.

This study was made in the New York Botanical Garden and the author expresses his thanks for the excellent facilities and coöperation.

EXPLANATION OF PLATE 25

Figs. 1–19. Early stages in the formation of the perithecia.

Figs. 20–22. Later stages in the development of the perithecia.

Fig. 23. Section of a perithecium, showing two zones of cells forming the wall and a central mass of parenchyma cells.

Fig. 24. Section of a perithecium approaching maturity, showing the formation of the rostrum and asci and the disintegration of the parenchyma cells before the advancing asci.

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THE TRUFFLE INDUSTRY OF ITALY

C. G. Lloyd

Many people, particularly Americans and English, have a wrong idea of truffles. They seem to think that they are a kind of underground tuber that are eaten by the French as we eat potatoes. That is far from the truth.

Truffles are underground fungi, hypogaeal fungi as they are called, that are very fragrant and of good flavor, but of relatively rare occurrence and hard to find, and always bring a high price in the market. They are used as a flavoring for meat gravies, and are highly prized by the wealthy French and Italian gourmands for that purpose. Their high price precludes their use by the ordinary French or Italian people.

The black truffle, in normal conditions before the war, was sold in Paris from ten to twenty francs per kilo—that is, from one to two dollars per pound. The white truffle, which is more esteemed in Italy, is now sold from one hundred to four hundred lires per kilo, according to the season—that is, in our money at current rates, from five to twenty dollars a pound. At these prices it is needless to say that truffles are not used as food, but as a flavoring. The white truffle (*Tuber magnatum*) is particularly esteemed in Italy. It does not occur in France and only the black truffle is ordinarily sold in the French markets. In Italy the black truffle is not so popular and sells from five to ten lires a kilo—about twenty-five cents to one dollar a pound at present rates of exchange. The black truffle really consists of four species of *Tuber* (*Tuber aestivum, T. brumale, T. melanosporum,* and *T. macrosporum*), but they are not distinguished in the trade, and I was told by a truffle dealer, who has been engaged in the truffle trade for years, that there is but one kind of black truffle.

Truffles grow only in calcareous soil, and only in relation to the roots of certain trees, chiefly the oak, and buried and attached to the rootlets of the trees at a depth of two to six inches. Their

relation to the rootlets of the trees is not that of a parasite, but rather a friendly association.

In southern France, in the neighborhood of Carpentras, which is the center of the French truffle trade, there are large farms which are employed only to grow truffles; in Italy, however, there is no such industry. Italian truffles are collected only in the copses or wild, wooded parts of the foothills of the Alps, where they grow naturally. It is the country people who have truffle dogs. They hunt for them and collect them in the season and sell them to the merchants of villages, who market truffles the same as our country merchants market eggs.

Truffles develop during the summer and mature in the fall. They find the white truffle beginning in September and the black truffle about a month later and continuing into December. However, October is the principal truffle month.

The foothills of the Alps in Italy are one large vineyard, and as truffles will not grow except in uncultivated ground, nor in the vast plains of Italy, the places where they are found are relatively very restricted. It was fortunate that I learned from a reliable source the information from which I have extracted the foregoing. I have for years been in correspondence with Prof. O. Mattirolo, of Turin, Italy, who has made a special study for forty years of the classification of hypogaeal fungi, as truffles and other underground fungi are known. There are many kinds of hypogaeal fungi that are not truffles and are not used in commerce. Most species are too rare, or too small, or do not have the flavor, while some are even poisonous.

He may not realize it, for he is a very modest man, but Professor Mattirolo is the only one who has a thorough knowledge of their classification—the only man on earth who has studied them and collected them and worked with them for so many years that he has become the one authority on the subject. It was that fact that brought me to Turin, and Professor Mattirolo was most kind to me. He planned a trip for me to the section about sixty miles from Turin where truffles grow. He arranged with a truffle hunter to bring his dogs and demonstrate the manner in which they are collected. First, we went by rail about forty miles to Casale, where we were the hosts of Dr. Luigi Gabotto, who is director of

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the Pathological Institute at Casale and a man of considerable business interests. He has a large place near the town (which we visited) where he grows grapevines by the thousand grafted on American wild stock to resist Phylloxera, an insect that has destroyed many vineyards in that region. He placed an automobile at our disposal and accompanied us about twenty miles distant to Crea, which is a religious reservation of many acres on one of the foothills of the Alps. There we met by appointment Enrico Lanfrancone and his father, Pietro Lanfrancone, with his two truffle dogs. The young man is a truffle dealer at Moncalvo, the center of the truffle trade of this region. He is said to have made a fortune in the business. His father is now the owner of a café at Moncalvo, but he is an old truffle hunter and has hunted in the region for years.

As truffles grow beneath the ground and give no surface indication, they would be found only by the merest chance were it not for the aid of dogs. These dogs are most intelligent animals, trained especially to hunt truffles. It is not natural for a dog to hunt truffles as they hunt for rabbits in our country. There are men who make a business of training truffle dogs and I am told that a good dog commands a high price, sometimes as much as one hundred dollars.

Under the direction of the master's voice—and the dog seems to understand every word his master speaks—he smells the surface of the ground very closely. When he scents a truffle he scratches the dirt away to a depth of four or five inches. The master watches the operation and picks up the truffle when it is thrown out with the dirt and rewards the dog with a small piece of bread for every truffle found. Our visit was not made during the truffle season and all we found was a few small specimens not larger than hazelnuts, but it was most astonishing to me to note how the dog seemed to understand just what was expected of him. It was wonderful how he could detect by its odor a small truffle, perhaps not larger than a pea, buried to a depth of five or six inches.

In conclusion, I wish to acknowledge my indebtedness to the gentlemen previously mentioned, and particularly to the old truffle hunter, Signor Pietro Lanfrancone, and his most intelligent dogs.

TURIN, ITALY.

NOTES AND BRIEF ARTICLES

(Unsigned notes are by the editor)

Dr. N. Patouillard, of Paris, writes me that he has left the drug business and taken Hariot's place at the Museum. His present address is 32 Avenue de Neuilly.

An excellent description of potato diseases in compact form, prepared by G. R. Bisby, was published in March, 1923, as Extension Bulletin 66 of the Manitoba Agricultural College.

Sclerotinia carunculoides, the cause of a serious disease of the fruit of *Morus alba* in South Carolina, is described as new by E. A. Siegler and Anna Jenkins in the *Journal of Agricultural Research* for March 10, 1923.

A bacterial disease of foxtail, caused by *Pseudomonas alboprecipitans* Rosen, is discussed in great detail by H. R. Rosen in the *Annals of the Missouri Botanical Garden* for November, 1922. This splendid paper is an excellent introduction to the bacterial diseases of grasses.

A specimen of *Daedalea quercina* found on willow was sent me by Mr. G. W. Martin, of Rutgers College, on May 14. Two hymenophores were collected in April at Mt. Bethel, New Jersey, growing on exposed heartwood of living *Salix alba vitellina.*

An old English book containing notes on plants found in North Wales, includes the following caution regarding fungi:

> "Let my advice perswade thy mynde
> not to truste any of that kynde,
> such as be taken for the beaste (best)
> doe prove as poisnusse as the reste."

Young chestnut trees in California have recently been attacked by a species of *Fusicoccum,* which produces a disease similar to that caused by the chestnut canker in the eastern United States.

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For an account of the symptoms, distribution, and treatment, see a paper by C. E. Scott in Monthly Bull. Dept. Agr. Cal. **11**: 740. 1922.

Decays and discolorations in airplane woods are discussed in a comprehensive way by J. S. Boyce in Bulletin 1128 of the U. S. Dept. of Agriculture, dated February, 1923. The 43 pages of text are accompanied by 7 handsome colored plates.

"Trees as Good Citizens" has been most generously distributed by its author, Mr. Charles Lathrop Pack. Chapter 18 is devoted to the fungous diseases of trees and their treatment.

A preliminary list of Manitoba fungi prepared by G. R. Bisby and A. H. R. Buller appeared in the *Transactions of the British Mycological Society* for December 14, 1922. The list contains 574 species, of which 80 are rusts, 63 polypores, and 108 agarics.

The biology of *Schizophyllum commune*, with special reference to its parasitism, has been investigated by V. A. Putterill (Dept. Agr. Union S. Africa, Sci. Bull. 25, 1922), who finds this fungus able to grow on the living wood of various fruit trees, feeding upon the cellulose and doing considerable damage.

A new disease of ferns, caused by *Alternaria polypodii*, was described by T. G. Major in the annual report of the Quebec Society for the Protection of Plants for 1921–1922. The host (*Polypodium* sp.) was growing in the experimental greenhouse at Macdonald College, and the fungus caused brown, concentrically zoned spots on the fronds and stems.

Four very important papers on the Species Concept read at the Toronto Meeting were published in the *American Journal of Botany* for May, 1923. George H. Shull discusses the subject as a geneticist; R. A. Harper as a morphologist; Guilford Reed as a physiologist and bacteriologist; and E. C. Stakman as a plant pathologist.

An article on the mycological flora of the higher Rockies of Colorado, by C. H. Kauffman, has just reached me as a reprint from the first volume of the *Papers of the Michigan Academy of Science*. This important paper deals with all groups of fungi and includes descriptions of the following new species: *Helotium alnicola, Boletus tomentosus, Cortinarius bistreoides, C. citrinellus, C. glaucopoides, C. griseoluridus, C. metarius, C. nigrocuspidatus, C. pinetorum, Marasmius piccina, M. pinastris,* and *Pholiota platyphylla.*

In the report of the New York State Botanist for 1921, issued May 15, 1923, Dr. House lists 42 species of fungi new to the state, several of which are described as new in this report. A paper by Dearness & House includes the following new species: *Glocosporium polygoni, Gnomonia papillostoma, Haplosporella dulcamara, Microdiplodia spiraeocola, Mycosphaerella oxycocci, Septoria pallidula, Spegazzinea rubra,* and *Sphaerulina acori.* Notes on a number of miscellaneous fungous collections are largely based on determinations by Dr. E. A. Burt and Dr. J. C. Arthur.

Forest pathology in relation to forest conservation was discussed by J. H. Faull in the annual report of the Quebec Society for the Protection of Plants for 1921–1922. The cause of white pine needle blight appears to lie in the absorbing roots, which are dead in blighted trees. The fungus, *Fomes fomentarius,* causing heart-rot of birch and beech enters living trees through wounds and dead stubs, and penetrates rapidly both sapwood and heartwood. According to the author, "Timber cured while the decay is in its incipient stages is indistinguishable from sound timber. Infection of birch appears to be associated with the action of an insect boring at the crown."

The literature on the classification of the Hysteriales has been brought together by G. R. Bisby in the *Transactions of the British Mycological Society* for March 21, 1923. About 700 species in 46 genera have been described. According to the author, "The members of the Hysteriales were at first confused with lichens,

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certain of which they resemble. Early workers inevitably drew up vague descriptions of these fungi. The name of the group is based on the genus *Hysterium,* which was first used by Tode. The type species is *H. pulicare,* the name of which can be traced back to Lightfoot. Persoon succeeded in bringing a number of similar forms together, largely by an inclusive interpretation of the genus *Hysterium.* Chevallier first used the name 'Hysterineae' for an order, and he also separated into another order certain genera now included in the Phacidiales. This work has been generally overlooked in considering the beginning of a separate grouping on these fungi. Corda used the family name Hysteriaceae to include also the Phacidiales; most other workers, down to the middle of the 19th century, including Fries, placed the genera now classified in the Hysteriales with the Phacidiales. The genera came finally to be distinguished principally on the basis of the colour, shape, and septation of spores."

PROFESSOR HOLWAY

The death of Professor E. W. D. Holway, of the University of Minnesota, occurred March 31, at Phoenix, Arizona. Professor Holway returned in October from a year's collecting of fungi and flowering plants in South America with a slight indisposition, which was later diagnosed as influenza. Shortly after returning severe complications appeared, from which he sufficiently recovered early in March to make the trip to Arizona. His full recovery seemed to be assured, when his sudden and unexpected demise from heart failure occurred. He was seventy years of age.

For many years Professor Holway was a banker at Decorah, Iowa. His avocation was collecting. In his youth it was coins, then insects and various natural history objects. Along with these he secured books dealing with the different specialties, and took particular delight in early and rare volumes. During the 'seventies he turned to the collection of flowering plants, and in the 'eighties took up fungi. Eventually the plant rusts engaged the chief part of his attention.

Professor Holway had remarkable ability as a collector. He

not only obtained a great amount of material, but prepared it for the herbarium with unusual skill and neatness. It is to his indefatigable labors that the rust flora of northern California and the Selkirks, central Mexico, Guatemala, and Costa Rica have become well known. The extensive collections which he made in South America—Chile, Peru, Bolivia, and Ecuador in 1919–1920, and southern Brazil, Uruguay, and northern Argentina in 1921–1922—have not yet been sufficiently studied for publication.

J. C. ARTHUR

VIRGINIA FUNGI

During a visit to southwestern Virginia, July 10–20, 1923, a number of fungi were picked up at Mountain Lake (4,000 to 5,000 feet elevation) and Blacksburg (2,200 feet elevation). The season was, of course, more advanced at the lower elevation.

The most abundant fleshy species at Mountain Lake was *Russula foetens,* with *R. furcata* and a pretty red species fairly common and *R. delica* appearing only once. *Lactaria subdulcis* and *L. lactiflua* were just beginning to appear. *Collybia platyphylla* was found several times; *C. dryophila* twice; and *C. maculata,* a bitter species, once. *Omphalia campanella* was already well advanced and well distributed and a little white species of *Marasmius* was seen by the thousands on dead leaves and sticks, while *Mycena galericulata* had just begun to develop.

The only Amanita seen on the mountain was *A. Frostiana,* which was quite common in spots under the rhododendrons about the lake; and the only Amanitopsis was *A. vaginata,* represented by a few young hymenophores. *Chanterel cinnabarinus,* a bright-red species, was seen twice on the walk to Prospect Rock and *Hygrophorus psittacinus* once. I also made single collections of *Lepiota cristata, Paxillus involutus,* and *Hypholoma fasciculare;* the last, an intensely bitter species, appearing on roots in the road to Bald Knob.

The fairy-ring mushroom, *Marasmius oreades,* was beginning to develop in the lawns about the hotel; where *Pholiota praecox,* another edible species, was found twice. *Panaeolus campanulatus* and *Stropharia semiglobata* were the only dung-loving species

noticed. The oyster mushroom and a common species of Crepidotus were beginning to appear on dead deciduous wood, and I saw one group of the tiny "nests" of *Crucibulum vulgare*. A single puffball, *Lycoperdon gemmatum*, of this season was found; while the hard-skinned puffball, *Scleroderma aurantium*, was more advanced, being represented by a large group of mature sporophores. Two or three dozen old sporophores of *Geaster hygrometricus*, left over from last season, were noticed on the open ground where the bowling alley used to be, and one was found near the top of the mountain.

Of the boletes, only *Boletus communis* and *B. felleus* had made their appearance at this elevation, and these only in one or two specimens. *Laetiporus sulphureus* was found fully developed in large masses on a chestnut log near Prospect Rock, and *Coltricia splendens* grew in the path above the fossil bed. Near the hotel, the stems and fruits of a hawthorn tree were covered with the cluster-cup stage of a *Gymnosporangium*, and the hymenophores of *Fulvifomes Robiniae*, on black locust, were developing a new layer of tubes. *Elfvingia megaloma, Daldinia concentrica, Coriolus versicolor*, and several other woody and leathery species of wood-destroying fungi were seen on various kinds of decayed wood; while heart-rotting fungi like *Ganoderma Tsugae, Pyropolyporus ingiarius*, and *Elfvingiella fomentaria* appeared in considerable numbers as conspicuous brackets on the trunks of living hemlock, birch, and beech.

At Blacksburg, the first crop of fungi had matured, following copious rains. Many species were seen in Heath's Woods, Broce's Woods, and beyond Slusser's on the road to Dry Run, but I will not list these at present. A handsome specimen of *Cordyceps herculea*, not quite mature, was found in leaf-mold beneath a white oak growing from a buried insect; and a splendid cluster of *Pholiota Johnsoniana* was taken from the interior of a much decayed stump of some deciduous tree. This latter species, which was described and figured in MYCOLOGIA for September, 1915, is remarkable for its large white annulus and for its resemblance to certain species of *Stropharia*.

W. A. MURRILL

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